OPERATION & SERVICE MANUAL

PORTABLE, SELF-CONTAINED VENTILATION SYSTEM

(VENTILATOR, COMPRESSOR, AIR/OXYGEN MIXER)

UNI-VENT™ Eagle™
700 SERIES
MODEL 754M

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27 Fairfield Place
West Caldwell, New Jersey 07006

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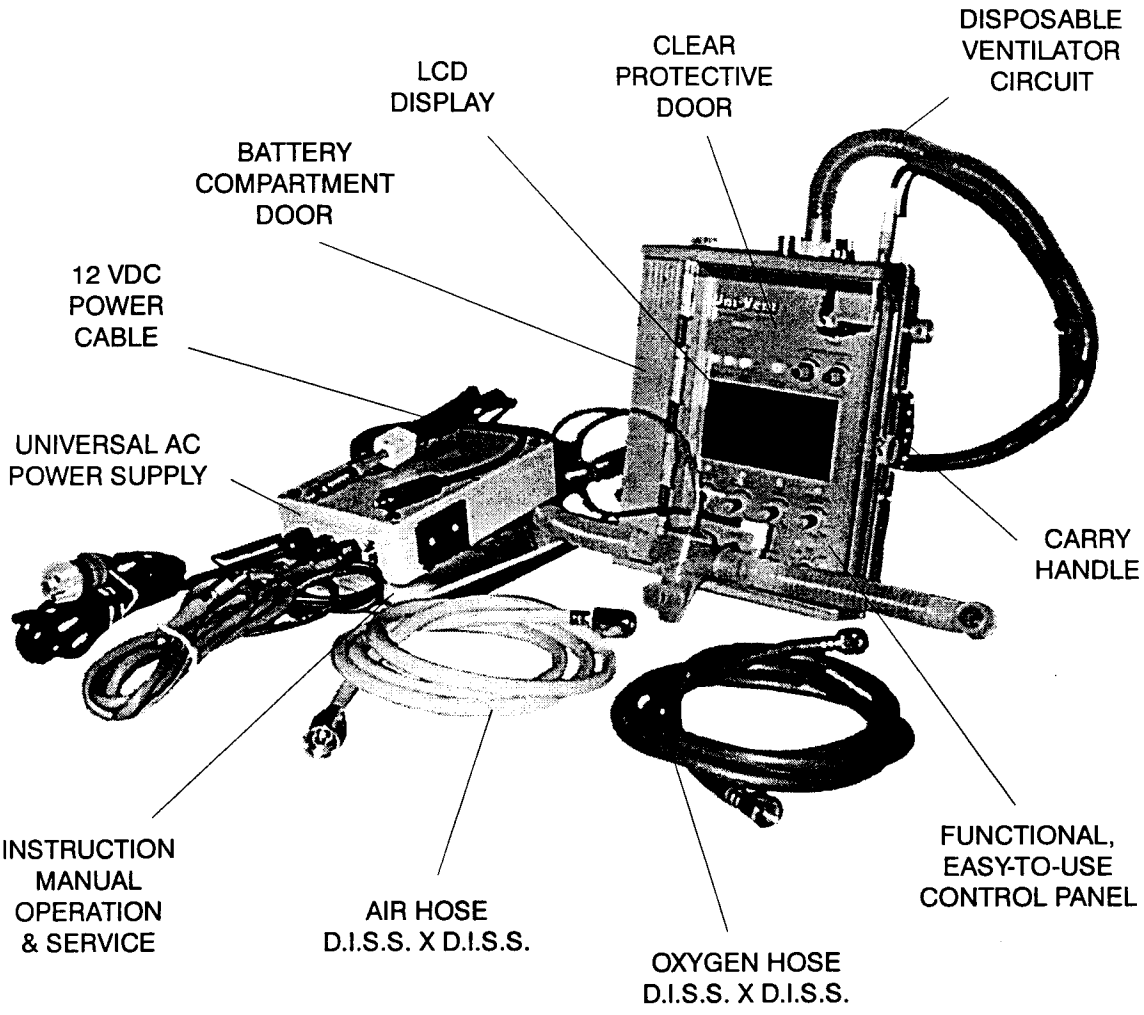

Figure 1. Model 754/754M Main Features

CONVENTIONS, TERMINOLOGY, DEFINITIONS AND ABBREVIATIONS AS USED IN THIS MANUAL

CONVENTIONS

WARNING
A WARNING message identifies conditions that could have an adverse effect upon the patient or operator.

CAUTION
A CAUTION statement identifies conditions that could damage this device.

NOTE
Information immediately following is of sufficient importance that emphasis is made.

TERMINOLOGY

Air/Oxygen Mixer - Blender, Gas Blender
Model 754/754M - Uni-Vent™
Pressure Plateau - Plateau
Uni-Vent™ - Model 754/754M, Ventilator, Eagle™
Ventilator-Compressor-Air/Oxygen Mixer - Ventilator

DEFINITIONS

Gas - Air or oxygen or the resultant mixture of these two gases
Ventilator - Any reference to the Model 754/754M, Uni-Vent™, Ventilator-Compressor-Air/Oxygen Mixer
- Denotes that display will indicate some number between 0 an 9 for each appearance of "#"

ABBREVIATIONS

Airway Pressure - P_{aw}
Alarm Message Center - AMC
Assist-Control - A/C
Assist-Control Ventilation(s) - ACV
Breaths Per Minute - BPM
Centimeters of Water - cmH_2O
Continuous Positive Airway Pressure - CPAP
delivered - del
End Tidal Carbon Dioxide - $ETCO_2$
Fraction of Inspired Oxygen - FIO_2
Light Emitting Diode - LED
Liquid Crystal Display - LCD
liters - L
Liters Per Minute - LPM
milliliters - ml
Oxygen - O_2
Peak Inspiratory Pressure - PIP
Positive End Expiratory Pressure - PEEP
Pounds Per Square Inch - PSI
Power Information Center - PIC
Synchronized Intermittent Mandatory Ventilation(s) - SIMV
Tidal Volume - V_T
Work-of-Breathing - WOB

A WORD ABOUT EAGLES

This very special Uni-Vent™ was named Eagle™, to represent its leadership role in the world of portable ventilators. Where the eagle has come to symbolize power - this Eagle™ represents the most powerful, self-contained portable ventilator available today. Where the eagle is known for its skills - this Eagle™ possesses skills never before found in a portable ventilator this small. And where the eagle is known for its keen sight - this Eagle™ sees a future that no other portable ventilator has ever seen. The Uni-Vent™ Eagle™ - its not just another bird!

SHIPPING CONTENTS

Each Uni-Vent™ Eagle™ Model 754 is shipped with the following components:

1 ea. Ventilator, Compressor, Air/Oxygen Mixer
1 ea. Ventilator Circuit, Disposable, Single Patient Use
1 ea. High Pressure Hose, D.I.S.S. Oxygen X D.I.S.S. Oxygen, 6' Long
1 ea. High Pressure Hose, D.I.S.S. Air X D.I.S.S. Air, 6' Long
1 ea. Universal AC Power Supply (standard)
1 ea. Universal AC Power Supply with 16-30V DC-DC Converter (optional)
1 ea. 12 VDC Power Cable
1 ea. Operator's Manual, Model 754/754M

Each Uni-Vent™ Eagle™ Model 754M is shipped with the following components:

1 ea. Ventilator, Compressor, Air/Oxygen Mixer
1 ea. Ventilator Circuit, Disposable, Single Patient Use
1 ea. High Pressure Hose, D.I.S.S. Oxygen X D.I.S.S. Oxygen, 6' Long
1 ea. High Pressure Hose, D.I.S.S. Air X D.I.S.S. Air, 6' Long
1 ea. Universal AC Power Supply with 16-30V DC-DC Converter
1 ea. 12 VDC Power Cable
1 ea. Case, Padded, Ventilator & Accessories
2 ea. Strap, Velcro®, 24" Long
2 ea. Instruction Manual, Operation & Service (Model 754M)

ACCESSORIES LIST

The Accessories List contains common items, required from time to time. Each item is preceded by its part number. Accessories may be ordered direct from Impact. When ordering, please include the part number, description and quantity required.

Send written purchase orders to: Impact Instrumentation, Inc.
P.O. Box 508
West Caldwell, New Jersey 07007-0508

Telephonic orders: 973/882-1212
Fax orders: 973/882-4993

PART NUMBER	DESCRIPTION
334-0020-00	Strap, Velcro®, 24" Long
402-0014-00	Case, Padded, Ventilator & Accessories
402-0016-00	Case, Padded, Ventilator
820-0067-00	Ventilator Circuit, Disposable, Single Patient Use
825-0002-00	High Pressure Hose, D.I.S.S. Oxygen X D.I.S.S. Oxygen, 6' Long
825-0004-00	High Pressure Hose, D.I.S.S. Air X D.I.S.S. Air, 6' Long
703-0754-02	Universal AC Power Supply with 16-30V DC-DC Converter
703-0754-07	Universal AC Power Supply
703-0754-03	12 VDC Power Cable
906-0754-01	Operator's Manual (Model 754/754M)
906-0754-02	Instruction Manual, Operation & Service (754M)

LIMITED COPYRIGHT RELEASE (Model 754M only)

Permission is hereby granted to the Department of Defense to reproduce all material furnished under this contract for use in a military service training program and other technical training programs.

CALIBRATION/PREVENTATIVE MAINTENANCE NOTICE

This device should be incorporated into a regular preventative maintenance program to insure compliance with operating specifications (see LIMITED WARRANTY statement). Calibration measurements should be made each year unless significant usage warrants a shorter period between preventative maintenance inspections. A complete calibration check should be made following each 2000 hours of cumulative use or 12-month period. A pressure-sensitive Calibration label is attached to the outer case, indicating when the last calibration was performed and the next calibration is due. DO NOT remove this label. Following 6-months of continuous storage/non-use, this device should be examined, operationally tested, and its batteries recharged before patient-use is attempted. Recommended maintenance checks can be found in the SERVICE section of the Model 754M Instruction Manual. The Model 754/754M contains internal clocks that monitor cumulative use and storage/non-use periods. Appropriate Advisory Alarm messages will appear in the Alarm Message Center when calibration/preventative maintenance is required.

UNPACKING

Compare shipping case contents against SHIPPING CONTENTS list. Examine instrument for any obvious signs of shipping damage. If there is no apparent sign of mechanical damage, read instructions contained within this Manual before attempting operation.

LOCATION OF USE

The Uni-Vent™ Eagle™, Model 754/754M, is a transportable device, therefore, its location of use will vary. When operated in a wet environment, users should take precautions and protect this device by covering it with a protective barrier (small tarp, plastic sheet, etc.).

WARNINGS AND CAUTIONS REGARDING USE

WARNING: Electric shock hazard, do not remove equipment covers.

WARNING: Do not operate this instrument prior to reading instructions contained within this Manual.

WARNING/CAUTION: Possible explosion hazard if used in the presence of flammable anesthetics.

WARNING/CAUTION: DO NOT block or connect the ventilator circuit hose to the Internal Compressor Air Filter port (see Figure 2).

CAUTION: Federal law restricts this device to sale by or on the order of a physician.

WARNINGS AND CAUTIONS REGARDING USE, (cont'd)

CAUTION: Service is to be performed by qualified biomedical equipment technicians only (for Model 754M, see SECTION entitled SERVICE).

CAUTION: Do not allow oil and grease to enter system. See ROUTINE CARE AND MAINTENANCE section entitled CLEANING for additional instructions.

CAUTION: Internal components are susceptible to damage from static discharge.

ASSEMBLY, INTERCONNECTIONS AND INITIAL ADJUSTMENTS

ASSEMBLY:

Model 754 - No assembly is required before placing this device into operation.

Model 754M - Depending upon contract requirements, battery pack installation may be necessary. Please check your contract accordingly. If battery pack installation is required, see BATTERY CARE AND RECHARGING section for instructions.

INTERCONNECTIONS:

CAUTION: Follow interconnection instructions prior to placing this device into service (see Figure 2).

- 1. For use with external oxygen: connect high pressure oxygen hose between OXYGEN inlet port and a 50-PSI external oxygen source. Use only medical-grade oxygen (see Figures 5a and 5b).
- 2. For use with external air: connect high pressure air hose between AIR inlet port and a 50-PSI external air source. Use only medical-grade compressed air (see Figures 5a and 5b).
- 3. Connect a disposable ventilator circuit to its respective gas outlet, transducer, and exhalation valve connectors on the Model 754/754M Connector Panel. Observe directions included with each disposable ventilator circuit (see Figure 4).
- 4. Connect Universal AC Power Supply, or 12 VDC Power Cable, between EXTERNAL POWER JACK and external power source (see Figure 5b).

NOTE: The standard Universal AC Power Supply is operable from AC voltages between 90 and 265 volts, 47 to 440 Hz. Voltage and line frequency sensing is automatic. An optional Universal AC Power Supply (standard with Model 754M), is operable from 115/230 VAC, 50 to 400 Hz (voltage and line frequency sensing is automatic), and includes a 16-30V DC-DC Converter. It accepts external DC voltages ranging from 16 to 30 volts which connect to the secondary input leads provided. Attachment to a mating connector is required and polarity must be observed. The black input lead is positive, white is negative. Do not attach the braided shield.

NOTE: For 11-15 VDC operation, connect an appropriate power cord between EXTERNAL POWER JACK and the 11-15 VDC power source. A 12 VDC Power Cable is provided for attachment to an automotive power source, negative ground.

INITIAL ADJUSTMENTS:

Before placing this device into operation, read section entitled OPERATION: DESCRIPTION OF CONTROLS, VISUAL INDICATORS AND CONNECTIONS. Make control settings and verify device performance prior to patient use.

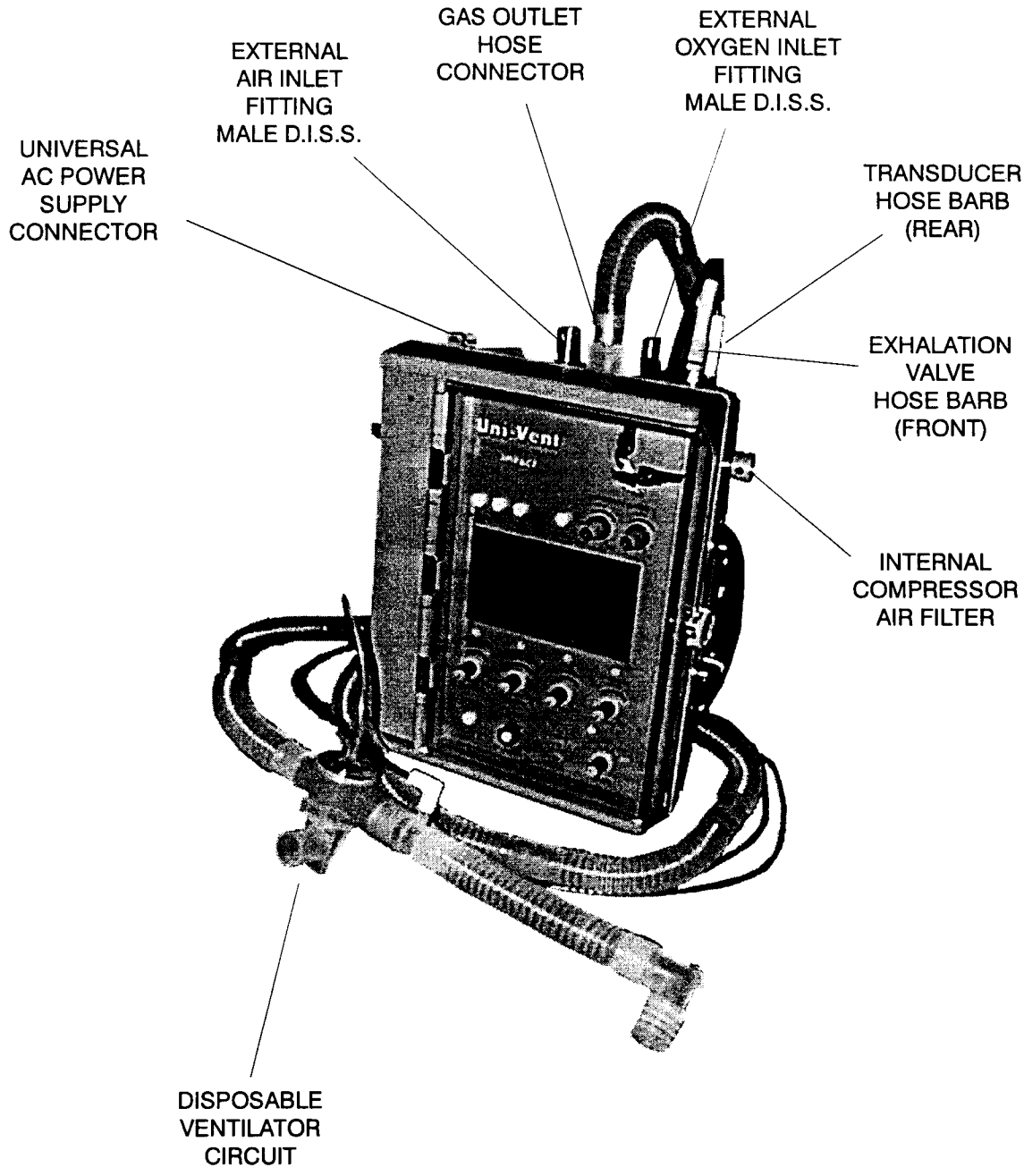
GAS OUTLET HOSE CONNECTOR
EXTERNAL OXYGEN INLET FITTING MALE D.I.S.S.
EXTERNAL AIR INLET FITTING MALE D.I.S.S.
UNIVERSAL AC POWER SUPPLY CONNECTOR
TRANSDUCER HOSE BARB (REAR)
EXHALATION VALVE HOSE BARB (FRONT)
INTERNAL COMPRESSOR AIR FILTER
DISPOSABLE VENTILATOR CIRCUIT
Uni-Vent

Figure 2. Interconnection Diagram

SECTION I. OPERATION

INTRODUCTION

User's will find this instrument quite easy-to-learn and operate. The following text presents a brief overview of device features. A complete understanding of its capabilities and limitations will allow you to take advantage of its many features.

Your Model 754/754M is a portable, electronically controlled ventilator, compressor, air/oxygen mixer. It is controlled by an internal microprocessor (CPU) which continuously monitors and displays airway pressure, control settings, alarm parameters, gas source(s), gas flows, gas blends, and power signals. ACV, SIMV and CPAP modes are operable with or without PEEP, with or without SIGH. ACV and SIMV are operable with or without Pressure Plateau. All modes are PEEP and altitude compensable to minimize your patient's work-of- breathing and automatic ventilatory backup assures continued mechanical support if the patient becomes apneic. An adjustable pressure limit control limits peak inspiratory pressures and high pressure alarm setpoint.

The Model 754/754M can provide gas mixtures with oxygen content ranging from 21 to 100%. Gases may be blended from external oxygen (compressed gas cylinder or PTLOX) and internal compressor, or external oxygen and external compressed air. External compressed air, delivered from an electric compressor, must be oil-less and filtered. Acceptable input gas pressures may range up to 80-PSI without effecting measurement accuracy or danger to internal componentry. It is operable in any position; upright, on its side, or lying flat.

Uni-Vent™ is operable from internal, rechargeable batteries; 11-15 volts DC (negative ground). Its battery pack may be recharged within the range of either of the aforementioned DC voltages. A Universal AC Power Supply and 12 VDC Power Cable is provided. The Universal AC Power Supply connects directly to AC mains providing 90 to 265 volts, 47 to 440 Hz. An optional Universal AC Power Supply (standard with the Model 754M) connects directly to AC mains providing 115/230 volts, 50 to 400 Hz (voltage and line frequency sensing is automatic), and permits use from external DC voltages, ranging from 16 to 30 volts which connect to the secondary input leads provided. Attachment to a mating connector is required and polarity must be observed. The black input lead is positive, the white is negative. Do not attach the braided shield. The Model 754/754M does not consume gas for operating power - all gas is dedicated for patient care.

Your ventilatory system employs a comprehensive alarm system. Alarms are categorized as Operating, Non-operating, or Advisory (see section entitled ALARM FUNCTIONS for complete descriptions of each alarm).

The Model 754/754M is extremely durable and designed for all environments. Its case is injection molded from polycarbonate material. It is appropriate for use with adults, children and infants - in clinical, field hospital, aeromedical, homecare, and prehospital (ALS, ATLS, ACLS) settings. Its small size and weight facilitates transport, deployment and storage.

FEATURES

- Microprocessor control of all functions including automatic monitoring of internal battery and external power sources, internal compressor and external gases.
- Extensive alarm monitoring of operating, non-operating and advisory conditions.
- Contemporary design to facilitate transport and placement.
- Gas-efficient electronic control circuitry eliminates all pneumatic-logic circuits, and any dependency on gas for operating power.
- Rechargeable batteries, fully compatible with vehicular electrical systems and airborne environments.
- Self-contained system, may be operated without attachment of external gas(es).

FEATURES, (cont'd)

- Numerical panel markings indicate sequence-of-operation steps to simplify and speed start-up.
- Graphics display includes 12-second pressure waveform, its amplitude is calibrated to the adjacent digital bar graph.
- Automatically compensates pressure transducer to altitude-related barometric pressure changes up to 25,000 ft.

DESCRIPTION OF CONTROLS, VISUAL INDICATORS AND CONNECTIONS

Uni-Vent™ contains various controls, indicators and connectors. Their placement has been carefully chosen to facilitate ease of use, visibility, and interconnection. A large, liquid crystal display (LCD) provides continuous display of graphics, control settings, operating conditions, and alarm status information. A clear door protects control panel components from weather, fluids and inadvertent contact.

CONTROLS

Control descriptions are listed based upon their control panel location, reading from left to right, top to bottom. Where applicable, corresponding LCD information is provided. Each is described in the following text (see Figure 3).

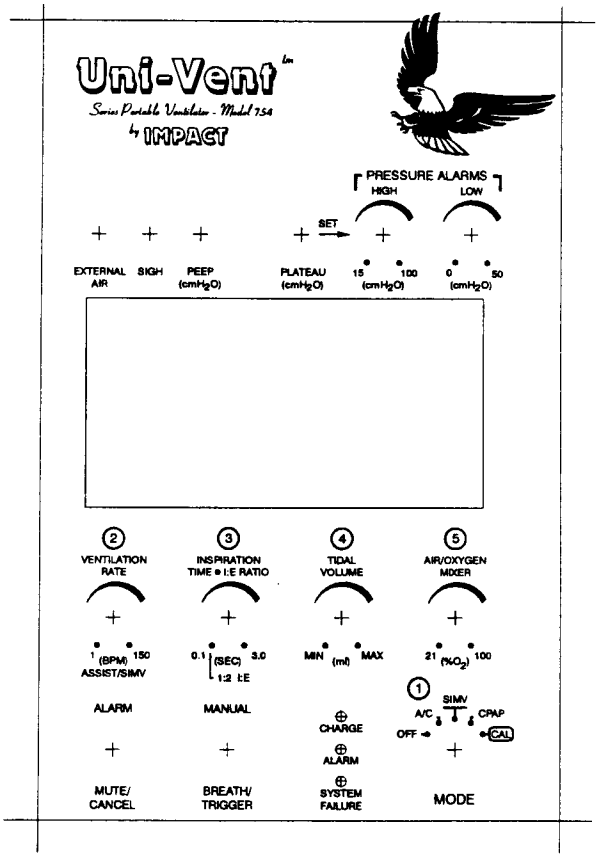

Figure 3. Control Panel

CONTROLS, (cont'd)

EXTERNAL AIR OFF/ON Pushbutton Switch: The EXTERNAL AIR Pushbutton Switch permits you to manually select external compressed air as your primary air source. When the ventilator is turned ON, its CPU "samples" the respective gas fitting and looks for an air pressure, greater than 40-PSI. If a lower pressure, or no pressure is sensed, the LCD will display "OFF" (default value), and the CPU allows operation from the internal compressor. If a pressure exceeding 40-PSI (+/- 2-PSI) is sensed, the LCD will display "ON", and allow operation from the external air supply. Manually pressing this pushbutton will toggle the display from "OFF" to "ON", or from "ON" to "OFF". Attempting to select "ON" with less than 35-PSI (+/- 2-PSI) present will cause an alarm to sound. The LCD display area for EXTERNAL AIR is on the top line, immediately below its respective pushbutton switch. The EXTERNAL AIR OFF/ON display will blank when a SYSTEM FAILURE Alarm occurs.

SIGH OFF/ON Pushbutton Switch: The SIGH OFF/ON Pushbutton Switch permits Uni-Vent™ to operate with or without SIGH. When activated, the first ventilator generated breath will be a SIGH. Additional SIGH ventilations are delivered once every 100 ventilations or 7-minutes, whichever occurs first. Each SIGH ventilation equals 150% of the INSPIRATION TIME setting (and exhalation period), which increases delivered volume by 50%. Proportionately increasing both the inspiration and exhalation time allows Uni-Vent™ to maintain I:E during SIGH. As a safety precaution, Uni-Vent™ does not allow the inspiratory portion of a SIGH breath to exceed 3-seconds. Manually pressing this pushbutton will toggle the display from "OFF" to "ON", or from "ON" to "OFF". "OFF" is its default value. SIGH becomes disabled ("OFF") in the CPAP mode, or when PRESSURE PLATEAU is selected ("ON"). The LCD display area for SIGH is on the top line, immediately below its respective pushbutton switch. The SIGH OFF/ON display will blank when a SYSTEM FAILURE Alarm occurs.

PEEP OFF/ON-SET Pushbutton Switch: The PEEP OFF/ON-SET Pushbutton Switch activates Uni-Vent™'s internal PEEP control. When the ventilator is turned ON, PEEP has a default value of 0 cmH_2O (no PEEP). Pressing the pushbutton allows a PEEP value to be manually entered (see section entitled USING POSITIVE END EXPIRATORY PRESSURE). The LCD display area for PEEP is on the top line, immediately below its respective pushbutton switch. The PEEP OFF/ON-SET display will blank when a SYSTEM FAILURE Alarm occurs.

PRESSURE PLATEAU OFF/ON Pushbutton Switch: The PRESSURE PLATEAU OFF/ON Pushbutton Switch permits ACV or SIMV operation with a pressure plateau. When the ventilator is turned ON, PLATEAU is OFF (default value). Pressing this pushbutton activates a PLATEAU value that is referenced 10 cmH_2O below the HIGH PRESSURE ALARM/PEAK INSPIRATORY PRESSURE RELIEF Control setpoint. Its absolute range is 5 to 90 cmH_2O. When this pushbutton is pressed, it will toggle the display from "OFF" to its PLATEAU value, or from its PLATEAU value to "OFF". PRESSURE PLATEAU becomes disabled ("OFF") in the CPAP mode. The LCD display area for PRESSURE PLATEAU is on the top line, immediately below its respective pushbutton switch (see section entitled USING PRESSURE PLATEAU). The PRESSURE PLATEAU OFF/ON display will blank when a SYSTEM FAILURE Alarm occurs.

HIGH PRESSURE ALARM/PEAK INSPIRATORY PRESSURE RELIEF Control: This control is used to select the HIGH PRESSURE ALARM and PEAK INSPIRATORY PRESSURE RELIEF setpoint. It has an absolute range from 15 to 100 cmH_2O. When the ventilator is turned ON, the HIGH PRESSURE ALARM/PEAK INSPIRATORY PRESSURE RELIEF Control setpoint value equals its current position. The LCD display area for HIGH PRESSURE ALARM/PEAK INSPIRATORY PRESSURE RELIEF Control setpoint is on the top line, immediately below its respective control. The HIGH PRESSURE ALARM Control setting display will blank when a SYSTEM FAILURE Alarm occurs.

LOW PRESSURE ALARM Control: This control is used to select the LOW PRESSURE ALARM setpoint. It has an absolute range from 0 to 50 cmH_2O. When the ventilator is turned ON, the LOW PRESSURE ALARM Control setpoint value equals its current position. The LCD display area for the LOW PRESSURE ALARM Control setpoint is on the top line, immediately below its respective control. The LOW PRESSURE ALARM Control setting display will blank when a SYSTEM FAILURE Alarm occurs.

CONTROLS, (cont'd)

VENTILATION RATE Control: The VENTILATION RATE control setting determines the mechanical ventilation rate for ACV and SIMV operation. It is not operable in CPAP (RATE = 0). Its range is from 1 to 150 breaths per minute (BPM). When the ventilator is turned ON, the VENTILATION RATE Control setpoint value equals its current position. The LCD display area for VENTILATION RATE Control setpoint is on the bottom line, immediately above its respective control. During APNEA, the RATE Control setting and its LCD display will change to 12 BPM. The VENTILATION RATE Control setting display will blank when a SYSTEM FAILURE Alarm occurs, or the CPAP mode is selected.

INSPIRATION TIME/I:E RATIO Control: The INSPIRATION TIME/I;E RATIO Control sets the inspiratory duration of all ventilator-delivered breaths. It is adjustable in 0.1 second increments from 0.1 to 3.0 seconds maximum. Its usable range is limited by the VENTILATION RATE Control setting. Inverse I:E Ratio's (inspiratory time is greater than expiratory time) are not permitted. (See section entitled ALARM FUNCTIONS). A default I:E ratio of 1:2 is activated when this control is turned to its fully counterclockwise position. When the ventilator is turned ON, the INSPIRATION TIME/I:E RATIO Control setpoint value equals its current position. Setting INSPIRATION TIME causes the resulting I:E RATIO to be calculated. Setting the default I:E RATIO (1:2) causes the INSPIRATION TIME to be calculated when VENTILATION RATE settings are changed. Inspiration time and I:E ratio are simultaneously displayed in the LCD. The LCD display area for INSPIRATION TIME/I:E RATIO Control setpoint is on the bottom line, immediately above its respective control. The INSPIRATION TIME/I:E RATIO Control setting display will blank when a SYSTEM FAILURE Alarm occurs or CPAP is selected. It will blink during INVERSE I:E conditions.

TIDAL VOLUME Control: The TIDAL VOLUME Control allows gas to be delivered over a wide range. Its maximum flow is equivalent to approximately 1000ml/sec (60 LPM). TIDAL VOLUME may be obtained from any of the following gas or gas combinations:

External Air (Cylinder)

External Compressed Air (Compressor)

Internal Air Compressor

External Oxygen and External Air Cylinder or Compressor, or Internal Air Compressor

External Oxygen

Tidal volume is calculated and displayed in milliliters (ml). When the ventilator is turned ON, the TIDAL VOLUME Control setpoint value equals its current position. Uni-Vent™'s CPU monitors and adjusts gas flow. Its LCD initially displays "#### set" TIDAL VOLUME for the first one or two delivered breaths, while the CPU makes whatever flow corrections are required, then the LCD alternately displays "#### set" TIDAL VOLUME and "#### del" TIDAL VOLUME. The LCD display area for TIDAL VOLUME Control setpoint is on the bottom line, immediately above its respective control. The TIDAL VOLUME Control setting display will blank when a SYSTEM FAILURE Alarm occurs or CPAP is selected.

AIR/OXYGEN MIXER Control: The AIR/OXYGEN MIXER Control allows air, oxygen, or mixtures of air and oxygen to be delivered. It has a range of 21% (all air) to 100% (all oxygen) and may be obtained from the following gas or gas combinations:

21% FIO_2 from External Air (Cylinder)

21% FIO_2 from External Compressed Air (Compressor)

21% FIO_2 from Internal Air Compressor

21 to 100% FIO_2 from External Oxygen and External Air Cylinder or Compressor

21 to 100% FIO_2 from External Oxygen and Internal Air Compressor

100% FIO_2 from External Oxygen

CONTROLS, (cont'd)

When the ventilator is turned ON, the AIR/OXYGEN MIXER Control setpoint value equals its current position. Uni-Vent™'s CPU monitors and adjusts gas flow according to the FIO_2 and TIDAL VOLUME setpoints. In CPAP mode, FIO_2 proportions are based on gas flowing at 1000ml/sec. The CPU makes any necessary flow corrections during the first one or two delivered breaths. Delivered FIO_2 is displayed in the LCD. The LCD display area for AIR/OXYGEN MIXER Control setpoint is on the bottom line, immediately above its respective control. The AIR/OXYGEN MIXER Control setting display will blank when a SYSTEM FAILURE Alarm occurs. It will blink when an EXT AIR LOW/FAIL, O_2 LOW/FAIL, or FIO_2 Alarm occurs.

ALARM MUTE/CANCEL Pushbutton Switch: Depending upon alarm category, the ALARM MUTE/CANCEL Pushbutton Switch can either mute an audible alarm signal, or cancel a particular alarm function.

Muting: Depressing this switch mutes the audible component of an Operating Alarm condition for a predetermined period (see ALARM FUNCTIONS). Alarm muting is reset when the current alarm condition no longer applies or the predetermined mute-period is reached (audible alarm will resound). A new alarm condition overrides a "muted" pre-existing alarm.

When an alarm causing condition occurs, the LCD ALARM MESSAGE CENTER will display the pertinent alarm message. The ALARM LED alternately flashes, at the same frequency as the accompanying audible alarm. Pressing the ALARM MUTE/CANCEL Pushbutton Switch causes the ALARM LED to stay on continuously. It will resume flashing when the mute period ends.

If a new alarm condition occurs during the mute period of a previous alarm, the new alarm will have no effect upon the display of that alarm. The new alarm will cause the ALARM LED to alternately flash and respond as previously described when the ALARM MUTE/CANCEL Pushbutton Switch is pressed.

Canceling: When depressed, the ALARM MUTE/CANCEL Pushbutton Switch cancels the audible component of an Advisory Alarm condition (see ALARM FUNCTIONS). During an APNEA alarm condition, it will cancel both the audible and visual APNEA alarms and the controlled ventilations that are automatically invoked at the onset of apnea. Cancellation of an APNEA alarm allows Uni-Vent™ to resume operation at the preset ACV, SIMV or CPAP settings.

MANUAL BREATH/TRIGGER Pushbutton Switch: The MANUAL BREATH/TRIGGER Pushbutton is operable two ways.

Pressing this control during normal CPU operation, delivers one MANUAL BREATH. Each MANUAL BREATH is equal to one complete ventilatory cycle consisting of the current INSPIRATORY TIME/TIDAL VOLUME settings and expiratory period. In the CPAP mode, a manual breath is delivered at a flow rate of 30 LPM, an inspiratory time of 1.67-seconds, and pressure limited at 40 cmH_2O. A MANUAL BREATH cannot be delivered until airway pressure has reached baseline (zero or PEEP). Each time a MANUAL BREATH is triggered, an audible beep is heard.

This control functions as a MANUAL TRIGGER backup, if a CPU failure occurs in the primary system. The MANUAL TRIGGER contains dedicated circuitry capable of providing manually triggered breaths. For as long as this pushbutton is depressed, the MANUAL TRIGGER delivers a continuous gas flow at 30 liters per minute (LPM). A pressure relieving mechanism, contained within this circuit, limits peak inspiratory pressure from exceeding 40 cmH_2O.

The MANUAL BREATH/TRIGGER Pushbutton is protected against accidental contact by a circular guard.

MODE Selector Switch (OFF-A/C-SIMV-CPAP-CAL): The MODE SELECTOR Switch provides operating power in the ACV, SIMV, CPAP, and CAL positions.

Turning the MODE SELECTOR Switch from OFF to A/C, SIMV, or CPAP causes the microprocessor to perform a "SELF-CHECK" (see section entitled SELF-CHECK) before initiating operating in the selected mode. Ventilator operation will not begin until "SELF-CHECK" is successfully completed. Calibration of the airway pressure transducer is permitted in the CAL position only (see section entitled TRANSDUCER CALIBRATION).

VISUAL INDICATORS

When activated, STATUS, and ALARM INDICATORS are continuously displayed. All indicators are displayed within the LCD except for the ALARM, SYSTEM FAILURE, and CHARGE LED's which appear elsewhere on the control panel. When activated, the ALARM and SYSTEM FAILURE LED's illuminate red, the CHARGE LED illuminates green.

STATUS

MODE Indicator: Based upon the MODE Selector Switch setting, this indicator displays, respectively, ASSIST, SIMV, CPAP, or CAL. The MODE Indicator display will blank when a SYSTEM FAILURE Alarm occurs.

V_{min} Indicator: Displays Minute Volume (in liters) in the ACV mode, blanks during SIMV, CPAP and CAL or when a PLATEAU VOLUME or SYSTEM FAILURE Alarm occurs.

INSPIRATION/EXHALATION Indicator: Alternately displays the "INSPIRATION" or "EXHALATION" phase of mechanical and/or spontaneous breaths in each operating mode, blanks during CAL. The INSPIRATION/EXPIRATION Indicator display will blank when a SYSTEM FAILURE Alarm occurs.

POWER INFORMATION CENTER: The POWER INFORMATION CENTER (PIC) occupies a 2-line area in the LCD's lower left section. It illuminates when the MODE SELECTOR SWITCH is in any position except OFF and the CPU validates a usable source of power (see OPERATING POWER SELECTION & STOPPING) during the power check portion of SELF-CHECK (see SELF-CHECK). The POWER INFORMATION CENTER display will blank when a SYSTEM FAILURE Alarm occurs.

The POWER INFORMATION CENTER can display the following messages:

Line 1: "EXT PWR ON" or,

Line 1: "EXT PWR LOW" or,

Line 1: "EXT PWR FAIL" or,

Line 1: "EXT CHK FUSE" (flashing, see description below) or,

Line 1: Blank

"EXT PWR ON" denotes operation from an external power source. "EXT PWR LOW" denotes a low external power source voltage and works in conjunction with the EXTERNAL POWER LOW/FAIL Alarm (see section entitled ALARMS). This line is blank when no external power is connected.

Line 2: Battery icon "OK or,

Line 2: Battery icon "LOW" or,

Line 2: Battery icon "ON CHG" or,

Line 2: Battery icon "CHK FUSE" (flashing, see description below) or,

Line 2: Blank

Battery icon "OK" denotes (1) operation from internal batteries that have more than 30-minutes of remaining charge or, (2) in conjunction with external power operation, internal batteries can provide at least 30-minutes of operation. Battery icon "LOW" denotes (1) operation from internal batteries having less than 30-minutes of remaining charge (see section entitled ALARMS) or, (2) in conjunction with external power operation, internal batteries are being charged and currently have less than 30-minutes

VISUAL INDICATORS, (cont'd)

of operating time capability. Battery icon "ON CHG" is displayed , and the CHARGE LED illuminates, when charging current is flowing into the battery pack. This line will blank if no battery is sensed.

OPEN or MISSING FUSES: The POWER INFORMATION CENTER is able to identify open or missing fuses under the following circumstances:

1. During normal operation from external power, the External Power Operation & Charge Fuse opens (or is removed):

    a. EXT PWR FAIL/DISCONNECT Alarm activates, operation continues from internal battery.
    b. PIC Line 1 displays "EXT PWR FAIL".
    c. When Alarm Mute/Cancel pushbutton is pressed, the EXT PWR FAIL/DISCONNECT Alarm is reset.
    d. PIC Line 1 flashes "EXT CHK FUSE".

2. Prior to beginning operation from external power, the External Power Operation & Charge Fuse opens (or is removed):

    a. Operation begins from internal battery.
    b. PIC Line 1 flashes "CHK EXT FUSE".

3. During normal operation from external power, the Battery Operation & Charge Fuse opens (or is removed):

    a. Operation continues from external power.
    b. PIC Line 2 flashes battery icon "CHK FUSE".

4. Prior to beginning operation from internal battery (external power is not connected), and the Battery Operation & Charge Fuse opens (or is removed):

    a. The ventilator will not operate, its LCD will not illuminate.
    b. The SYSTEM FAILURE LED illuminates and a continuous tone sounds (non-mutable).

PEAK AIRWAY PRESSURE Indicator: Displays the PEAK AIRWAY PRESSURE of the previous breath. The PEAK AIRWAY PRESSURE Indicator display will blank when a SYSTEM FAILURE Alarm occurs.

MEAN AIRWAY PRESSURE Indicator: Displays the MEAN AIRWAY PRESSURE. Uni-Vent™ calculates MEAN AIRWAY PRESSURE to the following algorithm:

$$(\text{PIP-PEEP}) \times \frac{I}{\text{TOTAL CYCLE TIME}} + \text{PEEP}$$

The MEAN AIRWAY PRESSURE Indicator display will blank when a SYSTEM FAILURE Alarm occurs.

DIGITAL BAR GRAPH Indicator: The DIGITAL BAR GRAPH indicator provides continuous display of airway pressure. Its absolute range is from -10 to +100 cmH_2O. Increment markings appear every 10 cmH_2O, numerical markers appear at 0, 50 and 100 cmH_2O. Vertical resolution is 2 cmH_2O/bar. The DIGITAL BAR GRAPH Indicator display will blank when a SYSTEM FAILURE Alarm occurs.

HIGH and LOW AIRWAY PRESSURE ALARM Setpoint Indicators: The HIGH and LOW AIRWAY PRESSURE ALARM Setpoint Indicators appear as small horizontal lines to the right of the DIGITAL BAR GRAPH. Setpoint indicators are positioned according to their respective alarm control settings and reposition

VISUAL INDICATORS, (cont'd)

whenever an alarm control is adjusted. Setpoint indicator vertical resolution is 2 cmH_2O. The respective HIGH or LOW AIRWAY PRESSURE ALARM Setpoint Indicator blinks when a HIGH PRESSURE or LOW PRESSURE Alarm is triggered and blanks when a SYSTEM FAILURE Alarm occurs.

P_{aw} Indicator: The P_{aw} indicator represents a continuous and updating display of airway pressure. It display's the most recent 12-second period. Airway pressure amplitude along the vertical axis is calibrated to coincide with the adjacent digital bar graph. Markings along the horizontal axis represent 1-second intervals. The P_{aw} Indicator display will blank when a SYSTEM FAILURE Alarm occurs.

CHARGE Indicator: The green CHARGE Indicator LED illuminates whenever sufficient battery recharging current is flowing.

Control Setting Indicators: All control settings, except MODE SELECTOR Switch, appear on the LCD's upper and lower lines.

ALARM INDICATORS

The LCD display allocates up to 4-lines of alarm message information in a dedicated area. This dedicated area is called the ALARM MESSAGE CENTER (AMC). Each alarm is displayed in the LCD except for the ALARM Indicator and SYSTEM FAILURE LED's. The ALARM Indicator LED illuminates, and alternately flashes ON and OFF, whenever an alarm causing condition other than SYSTEM FAILURE occurs. An audible signal accompanies each alarm. Alarms are categorized as OPERATING, NON-OPERATING, or ADVISORY (for detailed information on alarms, see section entitled ALARM FUNCTIONS). When the audible signal is muted during an OPERATING ALARM, the ALARM Indicator LED remains illuminated, but stops flashing, during the mute period. During an ADVISORY ALARM pressing MUTE/CANCEL turns the ALARM Indicator LED OFF.

OPERATING ALARMS

BATTERY LOW/FAIL Alarm: Initiates when a low battery condition is sensed. When activated the AMC displays: BATTERY LOW/FAIL - RECHARGE/REPLACE BATTERY PACK, BATTERY LOW/FAIL or BATTERY. The AMC will blank if a non-operating alarm occurs.

EXTERNAL POWER LOW Alarm: Initiates when external power (as sensed at the External Power Jack), is less than 10.9 VDC. When activated the AMC displays: EXTERNAL POWER LOW - CHECK POWER SOURCE/CONNECTIONS or EXT PWR. The AMC will blank if a non-operating alarm occurs.

LOW PRESSURE Alarm: Initiates when PIP fails to exceed the LOW PRESSURE ALARM setpoint for two consecutive breaths and causes its LCD setpoint indicator to blink. When activated the AMC displays: LOW PRESSURE - PEAK INSPIRATORY PRESSURE TOO LOW or LOW PRESSURE. The AMC will blank if a non-operating alarm occurs. The setpoint indicator will alternately blink, with the HIGH PRESSURE Alarm LCD setpoint indicator, during a PRESSURE ALARM SETTINGS Alarm.

DISCONNECT Alarm: Initiates when a disconnect is sensed in the patient circuit. When activated the AMC displays: DISCONNECT - CHECK CIRCUIT CONNECTIONS or DISCONNECT. The AMC will blank if a non-operating alarm occurs.

HIGH PRESSURE Alarm: Initiates when PIP exceeds the HIGH PRESSURE Alarm setpoint for four consecutive breaths, or 2-seconds continuously, and causes its LCD setpoint indicator to blink. When activated the AMC displays: HIGH PRESSURE - PEAK INSPIRATORY PRESSURE TOO HIGH or HIGH PRESSURE. The AMC will blank if a non-operating alarm occurs. The setpoint indicator will alternately blink, with the LOW PRESSURE Alarm LCD setpoint indicator, during a PRESSURE ALARM SETTINGS Alarm.

APNEA Alarm: ACV and SIMV: initiates when approximately 19-seconds have elapsed and no pressure deflections have been sensed. When activated the AMC displays: APNEA - CHECK PATIENT FOR SPONTANEOUS BREATHING or APNEA. CPAP: initiates when no spontaneous breathing is detected for 10-seconds (based on a 30-second moving average). When activated the AMC displays: APNEA - CPAP AVERAGE RATE LESS THAN 6-BPM or APNEA. The AMC will blank if a non-operating alarm occurs.

VISUAL INDICATORS, (cont'd)

HIGH PEEP Alarm: Initiates when the inspiratory cycle begins before end expiratory pressure plateaus. When activated the AMC displays: HIGH PEEP - INSPIRATION BEGAN BEFORE END PRESSURE PLATEAU or HIGH PEEP. The AMC will blank if a non-operating alarm occurs.

O_2 LOW/FAIL Alarm: Initiates when low pressure is sensed from an external oxygen supply. When activated the AMC displays: O_2 LOW/FAIL - CHECK OXYGEN SOURCE/CONNECTIONS, O_2 LOW/FAIL or O_2. The AMC will blank if a non-operating alarm occurs.

EXT AIR LOW/FAIL Alarm: Initiates when low pressure is sensed from an external source of compressed air. When activated the AMC displays: EXT AIR LOW/FAIL - CHECK AIR SOURCE/CONNECTIONS, EXT AIR LOW/FAIL or EXT AIR. The AMC will blank if a non-operating alarm occurs.

FIO_2 Alarm: Initiates when the oxygen component or the air component of the AIR/OXYGEN MIXER is unable to meet its proportion of the gas mixture. When activated the AMC displays: FIO_2 - GAS MIX ERROR. CHECK SOURCE/SETTINGS/CONNECTIONS or FIO_2. The AMC will blank if a non-operating alarm occurs.

PRESSURE ALARM SETTINGS Alarm: Initiates when the HIGH PRESSURE ALARM and LOW PRESSURE ALARM setpoints are reversed (i.e.: low setpoint is set higher than the high setpoint). Both Control setpoint indicators, and both indicators adjacent to the DIGITAL BAR GRAPH, alternately blink during a PRESSURE ALARM SETTINGS Alarm. When activated the AMC displays: PRESSURE ALARM SETTINGS - ALARM SETTINGS REVERSED or PRESSURE ALARM SETTINGS. The AMC will blank if a non-operating alarm occurs.

V_T Alarm: Initiates when delivered tidal volume does not equal set tidal volume. When activated the AMC displays: V_T - DELIVERED TIDAL VOLUME DOES NOT EQUAL SET TIDAL VOLUME or V_T. The AMC will blank in the CPAP mode, or if a non-operating alarm occurs.

COMP Alarm: Initiates when the internal compressor output does not produce its intended contribution to tidal volume. When activated the AMC displays: COMP - COMPRESSOR OUTPUT LOW/FAIL or COMP. The AMC will blank if a non-operating alarm occurs.

NON-OPERATING ALARMS

INVERSE I:E Alarm: Initiates when inspiratory time becomes longer than expiratory time. When activated the AMC displays: INVERSE I:E - INSPIRATORY TIME LONGER THAN EXHALATION TIME or INVERSE I:E. The AMC will blank in the CPAP mode, or if a SYSTEM FAILURE Alarm occurs.

TRANSDUCER CALIBRATION ABORT Alarm: Initiates when the TRANSDUCER CALIBRATION process is stopped prematurely. When activated the AMC displays: TRANSDUCER CALIBRATION ABORT - RECALIBRATE TRANSDUCER or TRANSDUCER CALIBRATION ABORT. The AMC will blank if a MEMORY CHECK or SYSTEM FAILURE Alarm occurs.

SYSTEM FAILURE Alarm: LED, illuminates when CPU is forced to shutdown operation or a CPU failure has occurred. This alarm is usually related to a hardware problem and will cause the LCD to blank.

VENTILATOR FAIL Alarm: Initiates when any one of seven ventilator failure causing conditions occur. These conditions will not cause the LCD to blank, and some may be operator correctable. A VENTILATOR FAIL Alarm will cause the ALARM LED to illuminate. It will not cause the SYSTEM FAILURE LED to illuminate. The LCD will display: VENTILATOR FAILURE DETECTED followed by FAILURE CODE # (a number from 1 to 7), and an abbreviated description of the failure.

ADVISORY ALARMS

INSPIRATION TIME TRUNCATED TO 3-SEC Alarm: Initiates when control settings would cause inspiration time to exceed 3-seconds. It is disabled in the CPAP mode. When activated the AMC displays: INSPIRATION TIME TRUNCATED TO 3-SEC - NOTE I-TIME & I:E. The AMC will blank if a non-operating alarm occurs. A SIGH breath that would exceed 3.0-seconds is truncated but will not activate this alarm.

VISUAL INDICATORS, (cont'd)

PLATEAU VOLUME Alarm: Initiates when delivered PRESSURE PLATEAU tidal volume is less than set tidal volume by more than 5%. When activated the AMC displays: PLATEAU VOLUME - DELIVERED VOLUME LESS THAN SET VOLUME. The AMC will blank in the CPAP mode, or if a non-operating alarm occurs.

V_T SETTINGS Alarm: Initiates whenever the sum of the flows of the selected gases would exceed a flow rate of 60 liters per minute (LPM). When activated, the AMC displays: V_T SETTINGS - I-TIME X FLOW UNABLE TO DELIVER SET VOLUME or V_T SETTINGS. The AMC will blank in the CPAP mode.

PREVENTATIVE MAINTENANCE Alarm: Initiates after 2000-hours of cumulative use, or 12-months, whichever occurs first. When activated the AMC displays: PREVENTATIVE MAINTENANCE DUE - CONTACT CUSTOMER SERVICE. The AMC will blank if a non-operating alarm occurs.

EXTENDED NON-USE/STORAGE Alarm: Initiates at power-up after 6-months of continuous non-use/storage has occurred. When activated the AMC displays: EXTENDED NON-USE/STORAGE - TEST BEFORE PATIENT USE. The AMC will blank if a non-operating alarm occurs.

EXTERNAL POWER FAILURE Alarm: Initiates whenever external power fails, or is disconnected during external power operation. When activated the AMC displays: EXT PWR FAIL/DISCONNECT - CHECK POWER SOURCE/CONNECTIONS or EXT PWR FAIL/DISCONNECT. The AMC will blank if a non-operating alarm occurs.

TOTAL FLOW BACKUP Alarm: Initiates when the backup flow sensor detects the sum of the flows (O_2, Air, and internal compressor) exceeding set flows by +/- 50% for 5-consecutive breaths. There must be a total flow rate of at least 10 LPM and a total tidal volume of at least 200ml for this alarm to operate. When activated the AMC displays: TOTAL FLOW BACKUP - CONTACT CUSTOMER SERVICE. The AMC will blank if a non-operating alarm occurs.

CONNECTIONS

OXYGEN INLET: Nominal 50 PSI input, D.I.S.S. oxygen, male-thread. Connects to output of oxygen cylinder pressure reducer (medical-grade only), PTLOX; or on-board aircraft generated source. Use the high pressure hose, D.I.S.S. Oxygen X D.I.S.S. Oxygen, 6' Long, for interconnection.

AIR INLET: Nominal 50 PSI input, D.I.S.S. air, male-thread. Connects to output of air cylinder pressure reducer (medical-grade only), or electric compressor (oil-less and filtered). Use the high pressure hose, D.I.S.S. Air X D.I.S.S. Air, 6' Long, for interconnection. Note: To protect the ventilator from dirt and condensate, use an Air Inlet Filter/Moisture Trap whenever external air is provided by an electric air compressor.

GAS OUTLET: Low pressure, 22mm male tapered connection. Connects to disposable ventilator circuit 22mm I.D. corrugated hose (see Figure 4).

TRANSDUCER: Low pressure, fits 3/16" I.D. tubing. Connects ventilator pressure transducer to disposable ventilator circuit transducer hose (see Figure 4). This connector is colored green.

EXHALATION VALVE: Low pressure, fits 1/4" I.D. tubing. Connects ventilator exhalation valve control port to disposable ventilator circuit exhalation valve (see Figure 4). This connector is colored clear aluminum.

EXTERNAL POWER JACK: External power source connection. Connects ventilator to Universal AC Power Supply or external 11-15 volt power source via 12 VDC Power Cable (provided).

CAUTION
DO NOT connect external power sources rated higher than 15 volts or lower than 11 volts (see SPECIFICATIONS).

The EXTERNAL POWER JACK includes pins containing signals for the COMMUNICATIONS PORT

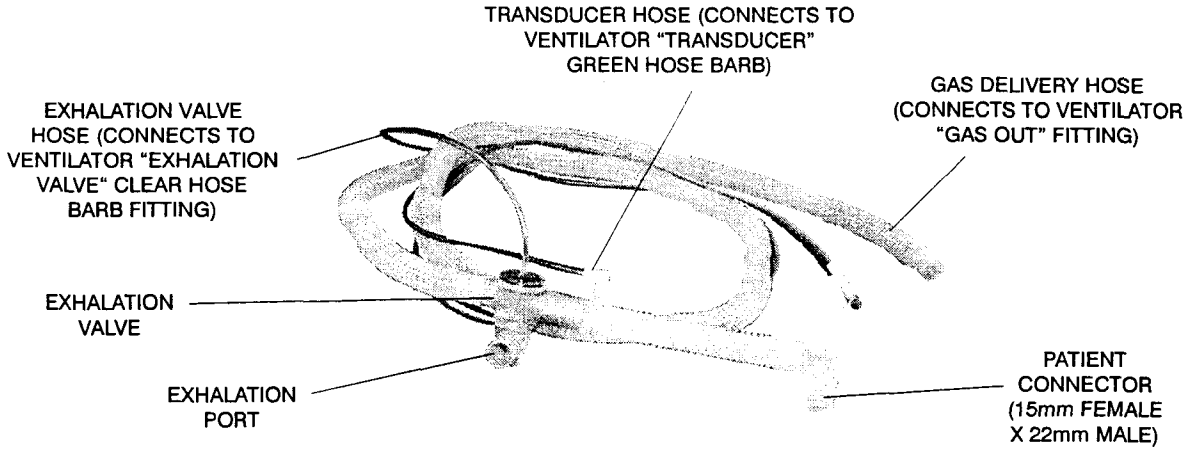
TRANSDUCER HOSE (CONNECTS TO VENTILATOR "TRANSDUCER" GREEN HOSE BARB)
GAS DELIVERY HOSE (CONNECTS TO VENTILATOR "GAS OUT" FITTING)
EXHALATION VALVE HOSE (CONNECTS TO VENTILATOR "EXHALATION VALVE" CLEAR HOSE BARB FITTING)
EXHALATION VALVE
EXHALATION PORT
PATIENT CONNECTOR (15mm FEMALE X 22mm MALE)

Figure 4. Disposable Ventilator Circuit

(Pins 2, 3 and 5). User's requiring communications capability during operation on battery power may special-order a DC COMMUNICATIONS CABLE from Impact's Customer Service Department.

The connector is wired as follows:	Power	Communications
	Pin 1 - Power (+)	Pin 2 - Send
	Pin 4 - Ground	Pin 3 - Receive
	Pin 6 - Shield	Pin 5 - Ground

COMMUNICATIONS PORT: The Model 754/754M provides a communications interface port for data exchange. The port consists of a standard, 9-Pin, Sub-D, Female, RS-232C connector which is located on the side of the Universal AC Power Supply. The connector is wired as follows:

Pin 2 - Send

Pin 3 - Receive

Pin 5 - Ground

Uni-Vent™'s communications port permits remote monitoring of ventilator functions and capabilities, including: switches, controls, alarms, and pressure signals.

- Switch, control, and alarm information is monitored and updated every second. Pressure signals are updated every 100-milliseconds.
- Control signals allow servicing personnel to perform "factory-level" device calibrations.

Contact Impact's Customer Service Department, for additional information on communications protocols. Requests for communications protocols must be made in writing and mailed to the attention of Customer Service Department Supervisor.

OPERATING POWER SELECTION & STOPPING

Uni-Vent™ is designed to operate from various voltages and frequencies (see SPECIFICATIONS). Its Universal AC Power Supply automatically accepts input voltages from 90 to 265 volts AC, 47 to 440 Hz.

DC operating voltages, within the range of 11 to 15 volts (negative ground), may be connected directly to the EXTERNAL POWER JACK. A 12 VDC Power Cable is provided for operation from a vehicular source or external 12-volt battery.

An optional Universal AC Power Supply (standard with the Model 754M), is operable from nominal 115/230 VAC, 50 to 400 Hz (voltage and line frequency sensing is automatic), and permits use from external DC voltages, ranging from 16 to 30 volts. The input leads provided require a mating connector and polarity must be observed. The black input lead is positive, white is negative. Do not attach the braided shield.

The MODE Selector Switch acts as a master power switch. Use this switch to initiate or cease operation.

Uni-Vent™ is designed to give operating power priority to external power rather than its internal battery pack. When a live external power source is applied, internal batteries are automatically placed on charge. When an external power failure occurs, Uni-Vent™ automatically switches to its internal battery pack for operating power and activates the EXTERNAL POWER FAILURE Alarm. When external power reappears, operation will switch from internal power to the external source.

Two external fuseholders are located adjacent to the battery compartment door. Each fuseholder contains a type 2AG, 10A fuse. The fuse closest to the top cover effects external power operation and battery charging. The other fuse effects battery operation and charging. POWER INFORMATION CENTER messages for "EXT PWR" and battery icon "ON CHG" will not display if their respective fuse(s) is/are blown or missing. See DESCRIPTION OF CONTROLS, VISUAL INDICATORS AND CONNECTIONS - POWER INFORMATION CENTER, for additional information.

INITIAL SET-UP, SELF-CHECK & TRANSDUCER CALIBRATION

INITIAL SET-UP: (Refer to Figures 5a and 5b).

Uni-Vent is easily configurable to suit most applications. Additional hoses, fittings and adapters may be required for particular uses. Figures 5a and 5b depict common applications.

TEST ALL CONFIGURATIONS FOR CORRECT OPERATION PRIOR TO PATIENT CONNECTION.

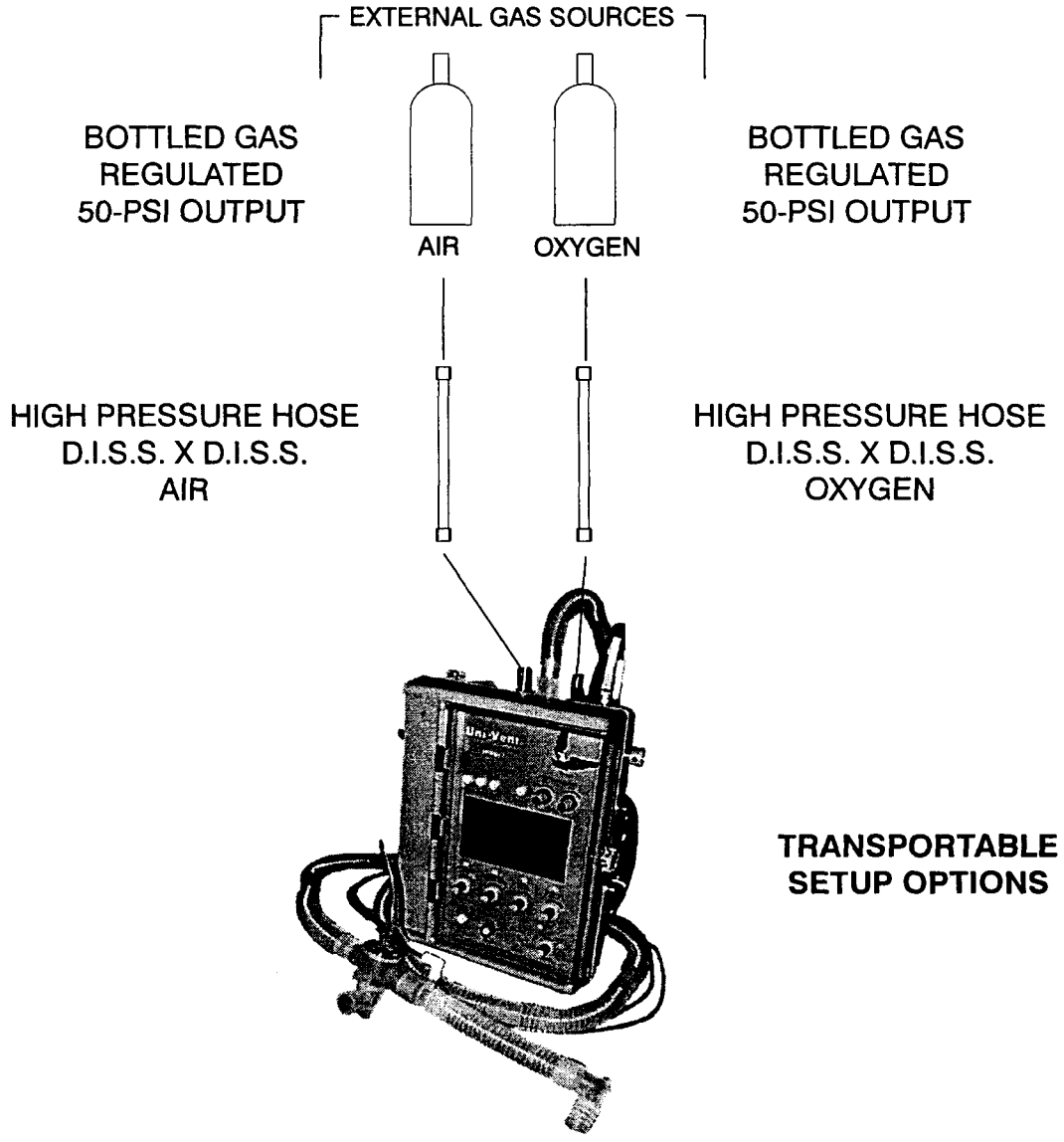
EXTERNAL GAS SOURCES
BOTTLED GAS REGULATED 50-PSI OUTPUT
AIR
OXYGEN
BOTTLED GAS REGULATED 50-PSI OUTPUT
HIGH PRESSURE HOSE D.I.S.S. X D.I.S.S. AIR
HIGH PRESSURE HOSE D.I.S.S. X D.I.S.S. OXYGEN
TRANSPORTABLE SETUP OPTIONS

Figure 5a. Initial Setup

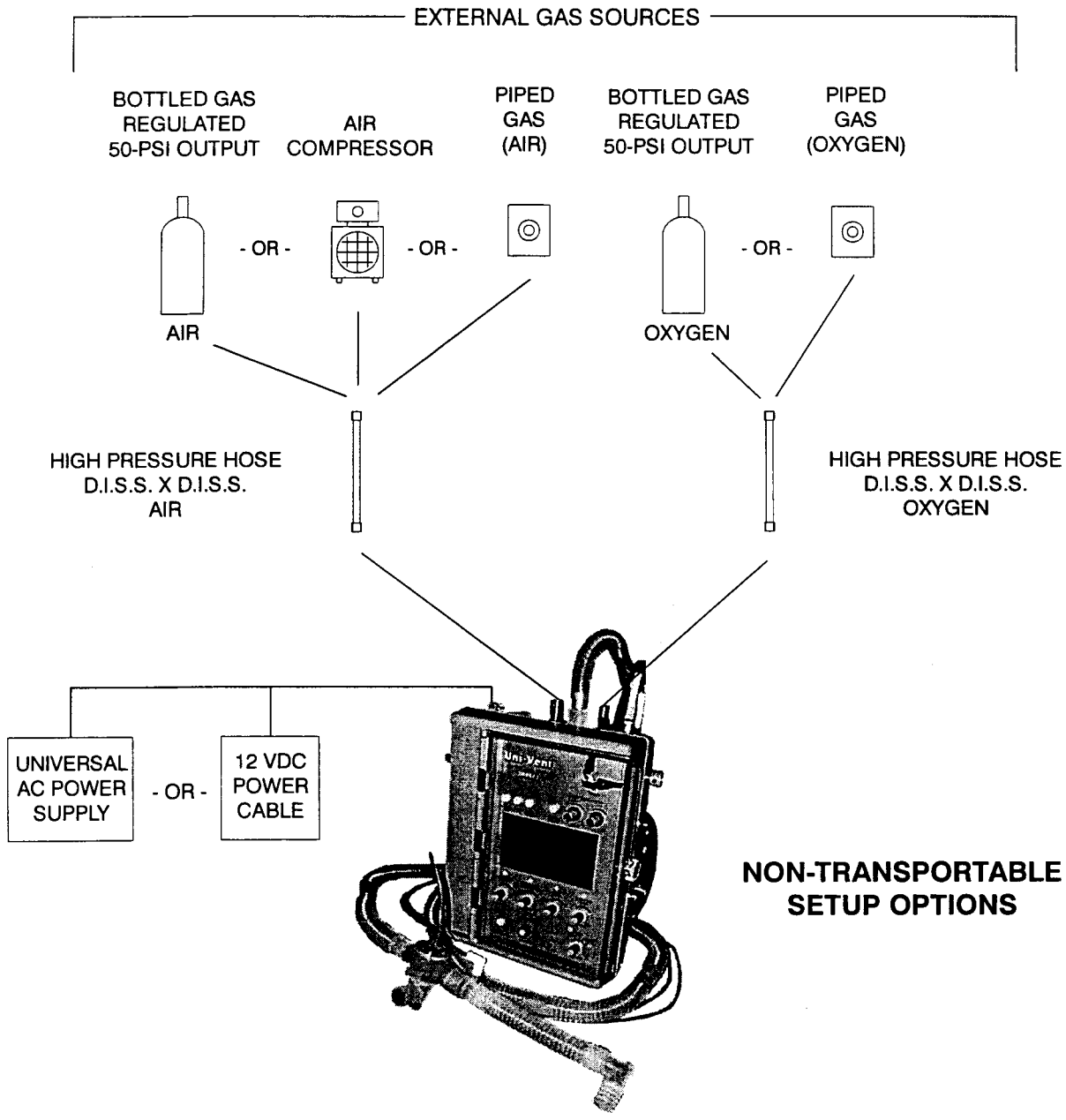

Figure 5b. Initial Setup

SELF-CHECK

Uni-Vent™ undergoes a self-checking process every time its MODE Selector Switch is turned from "OFF" to ACV, SIMV, or CPAP; or from CAL to ACV, SIMV, or CPAP. After the initial SELF-CHECK is performed, self-checking is not repeated if the operator turns the MODE Selector Switch to another operating mode position.

The SELF-CHECK process consists of interaction between Uni-Vent™'s microprocessor and peripheral circuitry to verify external power/internal battery status, memory check, pressure transducer calibration and control panel settings.

NOTE

If external oxygen and/or external compressed gas is connected, each gas pressure must be at least 40-PSI (+/- 2-PSI) at the time SELF-CHECK is performed.

WARNING

SELF-CHECK must be performed with the disposable ventilator circuit disconnected from the patient. This insures that the TRANSDUCER connection is open to ambient atmosphere. Ignoring this requirement could cause the SELF- CHECK process to sense a residual airway pressure. Current information is compared to previous calibration information stored in memory. Accordingly, any residual pressure would result in a false reading leading to a SELF-CHECK failure.

Operation begins immediately following SELF-CHECK.

If Uni-Vent™ fails SELF-CHECK, a VENTILATOR FAIL Alarm will occur. Return the MODE Selector Switch to its OFF position and then repeat this procedure. If SELF-CHECK fails again, contact qualified service personnel - DO NOT ATTEMPT PATIENT USE.

SELF-CHECK will automatically alert attendant personnel if the pressure transducer calibration "zero" baseline exceeds +/- 1 cmH_2O from its last calibration. A TRANSDUCER CALIBRATION Alarm activated during SELF-CHECK will cause an audible tone and the AMC to display:

TRANSDUCER CALIBRATION - CALIBRATE TRANSDUCER VENTILATOR FAILURE DETECTED FAILURE CODE 1 • SELF-CHECK FAILURE!	- OR - if SELF-CHECK Alarm is not related to the Transducer Calibration:	VENTILATOR FAILURE DETECTED FAILURE CODE 1 • SELF-CHECK FAILURE!

If only the pressure transducer calibration portion of SELF-CHECK fails, proceed to the section entitled TRANSDUCER CALIBRATION - DO NOT ATTEMPT PATIENT USE.

TRANSDUCER CALIBRATION

The disposable ventilator circuit connects to a pressure-sensing element (transducer) in the ventilator. The transducer, in turn, provides a stream of data to Uni-Vent™'s microprocessor. Transducer calibration information is stored in a serial, non-volatile EEPROM memory. This information is updated automatically during SELF-CHECK, then every 5-minutes thereafter through Eagle™'s AUTO CAL function, or, it can be manually updated by the user. Transducer calibration is essential for correct operation.

The TRANSDUCER CALIBRATION process calibrates Uni-Vent™'s internal pressure transducer to atmospheric pressure. During operation, Uni-Vent™'s microprocessor will respond according to pressure signals from the transducer which are compared to its control panel settings.

TRANSDUCER CALIBRATION, (cont'd)

AUTOMATIC CALIBRATION (AUTO CAL)

During operation, Eagle™ performs an automatic calibration of its pressure transducer every 5-minutes. This process maintains a consistent transducer baseline over a wide temperature range to assure display, monitoring, and triggering accuracy. If the baseline drifts significantly since the prior AUTO CAL was performed, or the baseline is unstable, Eagle™ will retry AUTO CAL 1-minute later. If AUTO CAL fails again, a VENTILATOR FAILURE Alarm, CODE 7 is activated to assure patient safety.

MANUAL CALIBRATION

WARNING

TRANSDUCER CALIBRATION, like SELF-CHECK, must be performed with the disposable ventilator circuit disconnected from the patient. This insures that the TRANSDUCER connection is open to ambient atmosphere. Ignoring this requirement would allow the procedure to sense any residual airway pressure in the patient circuit. The residual pressure becomes the new calibration reference (albeit a false reference), which will increase your patient's work-of-breathing by the residual amount.

- 1. Set MODE Selector Switch to CAL. The AMC will display:

  Calibration...Please Wait

  MODE = CAL

- 2. Calibration will take approximately 3-seconds. When finished, the AMC display will change to:

  MODE = CAL OK

NOTE

The PIC will display information pertinent to operating power and battery charge status in addition to the above AMC messages.

A TRANSDUCER CALIBRATION ABORT Alarm will occur if the MODE Selector Switch is turned to an operating mode position before CAL is completed. The CAL procedure must be restarted by turning the MODE Selector Switch to any position other than CAL, and then returning it to CAL, and repeating the process described in steps 1, 2 and 3 above. When activated the AMC displays: TRANSDUCER CALIBRATION ABORT - RECALIBRATE TRANSDUCER or TRANSDUCER CALIBRATION ABORT. The AMC will blank if a SYSTEM FAILURE Alarm occurs.

USER PROGRAMS

The Model 754/754M contains a USER PROGRAMS menu that allows certain operating characteristics to be changed. Some changes can be stored in Eagle™'s memory - temporary changes are not. Program changes that get stored in memory apply each time the ventilator is operated or, until the user makes a new program change effecting that particular characteristic. Temporary changes are not stored in memory and will last until ventilator power is turned OFF. User programmable/selectable characteristics are: LCD Backlight Threshold default, LCD Contrast default, Trigger Level Sensitivity, Set Spontaneous Flow, Demonstration Mode (DEMO), and TEST BACKUP VENTILATOR.

The bottom line of each menu in USER PROGRAMS contains the following information:

"#### Hrs" - where "####" represents cumulative hours of operation since the last Preventative Maintenance was performed.

USER PROGRAMS, (cont'd)

"### Dys" - where "###" represents cumulative days since the last Preventative Maintenance was performed

"Version #.##" - where #.## indicates the software version.

To enter the USER PROGRAMS menu, simultaneously press MUTE and MANUAL BREATH/TRIGGER Pushbutton Switches while turning the MODE Control Switch to A/C, SIMV, CPAP, or CAL.

- Follow on screen prompts.
- Press adjacent pushbutton switches to make your selections.
- Press pushbutton switch adjacent to "EXIT" to leave USER PROGRAMS menu and return to selected mode of operation:

A/C

A/C DEMO

SIMV

SIMV DEMO

CPAP

CPAP DEMO

CAL

LCD BACKLIGHT THRESHOLD DEFAULT: Sets the LCD's backlight setpoint. When programmed, it defaults to current ambient lighting conditions to assure adequate display illumination during operation. Changes can be stored in memory by pressing the pushbutton switch adjacent to the on screen "SAVE" prompt. If "SAVE" is not pressed, the previously stored setpoint remains.

LCD CONTRAST DEFAULT: Controls the LCD's contrast setpoint. Depending upon viewing comfort, user's may choose to increase or decrease color contrast between activated LCD pixels and their background. Any increase or decrease to the setpoint is seen on the LCD. Changes can be stored in memory or temporarily used during the current operating cycle. To store changes in memory, the pushbutton switch adjacent to the on screen "SAVE" prompt must be pressed. If "SAVE" is not pressed, the previously stored setpoint remains.

TRIGGER LEVEL SENSITIVITY: Controls the inspiratory work-of-breathing setpoint for patient-triggered breaths. Eagle™'s default sensitivity is 1.5 to 2.0 cmH_2O below end pressure. This USER PROGRAM allows Trigger Level Sensitivity to be temporarily changed until operating power is turned OFF. It is adjustable from 1.0 to 6.0 cmH_2O in 0.5 cmH_2O increments. For spontaneous breaths occurring in SIMV and CPAP, the sensitivity cannot be set below 2 cmH_2O. Sensitivity adjustments to 2 cmH_2O, or higher, will affect all breaths. Adjustments made below 2 cmH_2O will only affect mandatory breaths. New settings cannot be saved in memory. Once operating power is turned "OFF" Trigger Level Sensitivity is returned to its default value.

NOTE

Under most operating conditions Eagle™'s default Trigger Level Sensitivity should be used. User's are cautioned to carefully consider their operating environment before selecting a different Trigger Level Sensitivity. If 1.0 cmH_2O is selected, motion artifact may cause false triggering of breaths. Conversely, selecting a sensitivity above 2.0 cmH_2O to compensate for excessive motion artifact, or physiologic conditions, can cause excessive inspiratory work-of-breathing.

USER PROGRAMS, (cont'd)

SET SPONTANEOUS FLOW: Eagle™'s default Spontaneous Flow is 60 LPM. This USER PROGRAM allows Spontaneous Flow (for use in SIMV or CPAP) to be temporarily changed until operating power is turned OFF. It is adjustable from 10 to 60 LPM in 5 LPM increments. New settings cannot be saved in memory. Once operating power is turned "OFF", Spontaneous Flow is returned to its default value.

DEMONSTRATION MODE (DEMO): Permits user's to operate this device in a mode that is quite helpful for demonstration/training purposes. DEMO mode allows user's to make settings, adjustments, trigger alarms, and view simulation waveforms on Eagle™'s LCD. DEMO mode does not allow Disconnect Alarm activation or Proximal Pressure Transducer operation.

WARNING

DEMO mode is not for patient use. Once operating power is turned "OFF" DEMO mode is cancelled.

TEST BACKUP VENTILATOR: Permits user to test the BACKUP VENTILATOR and MANUAL TRIGGER. Activating the BACKUP VENTILATOR will cause it to function as described in the section entitled BACKUP VENTILATOR. To leave the BACKUP VENTILATOR function and return to normal operation, turn the MODE Control Switch to "OFF" then "ON" to desired operating mode.

MODES OF OPERATION

Your Model 754/754M has been carefully designed to ease the learning transition commonly associated with new instruments. In addition to its clean, uncluttered appearance, Uni-Vent™ includes numerical panel markings to simplify and speed start-up. Only the five primary controls, common to most applications, are marked. They are numbered in order of use, in a 5-step sequence. It is possible to initiate operation using as few as 3-controls.

- Step 1: Select operating mode; ACV, SIMV or CPAP
- Step 2: Set VENTILATION RATE
- Step 3: Set INSPIRATION TIME

NOTE

If your protocol calls for use only at the 1:2 I:E RATIO preset, Step 3 can be bypassed.

- Step 4: Set TIDAL VOLUME
- Step 5: Set the AIR/OXYGEN MIXER for an FIO_2 between 21 and 100

NOTE

If your protocol involves use without external oxygen, or with 100% oxygen, the AIR/OXYGEN MIXER control remains either fully counterclockwise or fully clockwise and control #5 can be bypassed.

Control panel settings may be adjusted at any time. In normal use, adjustments are typically made immediately following SELF-CHECK, however, the 1:2 I:E RATIO and extents for FIO_2 and PRESSURE ALARMS may be preset.

The Model 754/754M can operate in the following modes:

ASSIST-CONTROL VENTILATION: WITH/WITHOUT PEEP,
WITH/WITHOUT SIGH

ASSIST-CONTROL VENTILATION: WITH/WITHOUT PEEP,
WITH/WITHOUT PRESSURE PLATEAU

SYNCHRONIZED INTERMITTENT MANDATORY VENTILATION:
WITH/WITHOUT PEEP, WITH/WITHOUT SIGH

SYNCHRONIZED INTERMITTENT MANDATORY VENTILATION:
WITH/WITHOUT PEEP, WITH/WITHOUT PRESSURE PLATEAU

CONTINUOUS POSITIVE AIRWAY PRESSURE: WITH/WITHOUT PEEP

CONTROL VENTILATION (apnea backup of ACV, SIMV and CPAP)

CONTROL VENTILATION (backup ventilator)

WARNING

Functions which are dependent upon accurate pressure readings should only be used in conjunction with a protected airway. This will prevent "leaks" from distorting pressure signals. DO NOT use pressure dependent functions with an unprotected airway. This applies primarily to use with uncuffed endotracheal tubes, uncuffed tracheostomy tubes, and resuscitation masks where the face-to-mask-seal integrity is frequently and typically compromised.

MODES OF OPERATION, (cont'd)

IMPORTANT NOTE

The Model 754/754M includes preset trigger sensitivity default.

Preset trigger sensitivity default is set between 1.5 and 2.0 cmH_2O below end pressure. Triggering sensitivity determines how much negative deflection a spontaneously breathing patient must generate before Uni-Vent™ initiates a mechanical breath or demand flow. In the Model 754/754M, triggering sensitivity is both automatic and PEEP compensated. To change trigger sensitivity, or Spontaneous Flow for SIMV and CPAP, see section entitled (USER PROGRAMS).

During operation Uni-Vent™'s preset trigger looks for the next spontaneous breath to reach its trigger threshold. For whatever reason, if a spontaneous breath is in process when the trigger is activated, the following conditions prevail:

- If the patient's inspiratory pressure has not reached the trigger threshold, Uni-Vent™ will trigger when the threshold is reached.
- If the patient's inspiratory pressure has exceeded the trigger threshold, Uni-Vent™ will wait until the next spontaneous inspiration reaches threshold before triggering.

IMPORTANT NOTE

ACV, SIMV and CPAP ventilations are continuously monitored. Should apnea occur in one of these modes, Uni-Vent™'s microprocessor will activate applicable alarms and initiate control ventilations (see section entitled CONTROL VENTILATION DURING APNEA).

NOTE

Uni-Vent™ includes built-in altitude compensation. Once you've performed a TRANSDUCER CALIBRATION, changes in altitude will have no effect upon pressure-related performance.

NOTE

Uni-Vent™ has been certified by an independent testing laboratory to meet electromagnetic interference (EMI) and radio frequency interference (RFI) shielding requirements. Certification includes both radiated emissions and conducted susceptibility.

ASSIST-CONTROL VENTILATION (ACV)

In ACV, Uni-Vent™ is configured to deliver a minimum ventilatory rate, preset inspiration time and preset tidal volume. Patient-initiated breaths, sensed by negative pressure deflection, cause Uni-Vent™ to trigger an "assisted" ventilation that is equal to its INSPIRATION TIME and TIDAL VOLUME settings. Controlled ventilations are delivered when there are no spontaneous respiration's or the patients' spontaneous ventilation rate attempts to fall below the current VENTILATION RATE setting. If this occurs, controlled ventilations are delivered at the VENTILATION RATE, INSPIRATION TIME and TIDAL VOLUME settings.

Should the patient become apneic in the ACV mode, Uni-Vent™ will activate its APNEA Alarm and automatically begin controlled ventilations at its current VENTILATION RATE/INSPIRATORY TIME/TIDAL VOLUME control settings or 12 ventilations per minute/INSPIRATORY TIME/TIDAL VOLUME control settings - whichever is greater (see section entitled CONTROL VENTILATION DURING APNEA; *APNEA DURING ACV OR SIMV OPERATION*).

ASSIST-CONTROL VENTILATION (ACV), (cont'd)

ACV operation is permitted in combination with PEEP and/or SIGH, or PEEP and/or PRESSURE PLATEAU (SIGH will become disabled whenever PRESSURE PLATEAU is selected).

The following steps are required to initiate ASSIST-CONTROL operation:

- 1. Turn MODE Selector Switch to A/C. Allow SELF-CHECK tests to complete. Perform TRANSDUCER CALIBRATION if required (see section entitled TRANSDUCER CALIBRATION).

  DO NOT connect disposable patient circuit to patient during SELF-CHECK.

When SELF-CHECK is completed, ACV cycling begins automatically. The INSPIRATION/EXHALATION Indicator will toggle accordingly during the inspiratory and expiratory cycles of each ventilation.

NOTE:

When ACV cycling begins, the DISCONNECT Alarm will activate. This alarm will remain active until the disposable ventilator circuit is connected to the patient (see Step 3, below) and the pressure transducer detects a pressure rise during the next ventilator generated breath, or the ALARM MUTE/CANCEL Pushbutton Switch is pressed.

- 2. Adjust VENTILATION RATE, INSPIRATION TIME/I:E RATIO, TIDAL VOLUME, AIR/OXYGEN MIXER, LOW and HIGH AIRWAY PRESSURE ALARM Control settings as required. If LOW and HIGH AIRWAY PRESSURE ALARM's are not used, set their respective controls to 0 and 100.

- 3. Attach disposable ventilator circuit to patient's endotracheal or tracheostomy tube. Spontaneous breathing should cause the ventilator to trigger an assisted breath and cancel the DISCONNECT Alarm. A ventilator-generated controlled breath will also cause the DISCONNECT Alarm to cancel. The INSPIRATION/EXHALATION Indicator will continue to toggle during the inspiratory and expiratory cycles of each ventilation.

- 4. If PEEP is required, repeatedly press PEEP Pushbutton Switch until desired setting appears in LCD. (See section entitled USING POSITIVE END EXPIRATORY PRESSURE for complete instructions).

- 5. Press SIGH Pushbutton Switch if ACV operation with SIGH is required. SIGH ventilations are delivered once every 100 ventilations or 7-minutes, whichever occurs first. Each SIGH ventilation equals 150% of the INSPIRATION TIME setting, which increases delivered volume by 50%. As a safety precaution, Uni-Vent™ does not allow the inspiratory portion of a SIGH breath to exceed 3-seconds.

- 6. Press PLATEAU Pushbutton Switch if ACV operation with PRESSURE PLATEAU is required. SIGH is automatically disabled (OFF) when PLATEAU is selected. PRESSURE PLATEAU limits peak airway pressure to the PLATEAU level for the duration of an inspiratory cycle. The PRESSURE PLATEAU value is automatically referenced 10 cmH_2O below the HIGH PRESSURE ALARM/PEAK INSPIRATORY PRESSURE RELIEF Control setting (see section entitled USING PRESSURE PLATEAU).

SYNCHRONIZED INTERMITTENT MANDATORY VENTILATION (SIMV)

SIMV permits patients to breathe spontaneously while periodically receiving ventilator-generated assisted breaths. Microprocessor control of the disposable ventilator circuits' expiration valve determines which breaths are spontaneously entrained and which are mechanically delivered. FIO_2 is determined by the AIR/OXYGEN MIXER setting. Spontaneously breathing patients are allowed to entrain breathing gas, assuming the entire work-of-breathing for each spontaneous breath, at their own rate/inspiratory time. Assisted breaths are delivered as determined by the VENTILATION RATE, INSPIRATORY TIME/I:E RATIO, and TIDAL VOLUME control settings. Assisted breaths are synchronized to the patients ventilatory effort. However, if the patient does not breathe within the assisted breath "time window", a controlled breath is delivered to insure that the prescribed number of mandatory breaths are received.

SYNCHRONIZED INTERMITTENT MANDATORY VENTILATION (SIMV), (cont'd)

Should the patient become apneic in the SIMV mode, Uni-Vent™ will activate its APNEA Alarm and automatically begin controlled ventilations at its current VENTILATION RATE/INSPIRATORY TIME/TIDAL VOLUME control settings or 12 ventilations per minute/INSPIRATORY TIME/TIDAL VOLUME control settings - whichever is greater (see section entitled CONTROL VENTILATION DURING APNEA; *APNEA DURING ACV OR SIMV OPERATION*).

SIMV operation is permitted in combination with PEEP and/or SIGH, or PEEP and/or PRESSURE PLATEAU (SIGH will become disabled whenever PRESSURE PLATEAU is selected).

The following steps are required to initiate SIMV operation:

- 1. Turn MODE Selector Switch to SIMV. Allow SELF-CHECK tests to complete. Perform TRANSDUCER CALIBRATION if required (see section entitled TRANSDUCER CALIBRATION).

DO NOT connect disposable patient circuit to patient during SELF-CHECK.

When SELF-CHECK is completed, SIMV cycling begins automatically The INSPIRATION/EXHALATION Indicator will toggle accordingly during the inspiratory and expiratory cycles of each ventilation.

NOTE

When SIMV cycling begins, the DISCONNECT ALARM will activate. This alarm will remain active until the disposable ventilator circuit is connected to the patient (see Step 3, below) and the pressure transducer detects a pressure rise during the next ventilator generated breath, or the ALARM MUTE/CANCEL Pushbutton Switch is pressed.

- 2. Adjust the VENTILATION RATE (SIMV RATE), INSPIRATION TIME/I:E RATIO, TIDAL VOLUME, AIR/OXYGEN MIXER, LOW and HIGH AIRWAY PRESSURE ALARM Control settings as required. If LOW and HIGH AIRWAY PRESSURE ALARM's are not used, set their respective controls to 0 and 100.

During SIMV operation, mandatory breaths are delivered according to Uni-Vent™'s VENTILATION RATE, INSPIRATION TIME and TIDAL VOLUME control settings. When the mandatory breath is scheduled, Uni-Vent™'s trigger becomes momentarily armed so that it may synchronize with the patient's next inspiration. If there is no inspiratory effort during this period, a controlled breath is delivered regardless of patient effort.

During SIMV operation, mandatory breaths are delivered at the INSPIRATION TIME and TIDAL VOLUME settings.

- 3. Attach disposable ventilator circuit to patient's endotracheal or tracheostomy tube. Spontaneous breathing should cause the ventilator to trigger an assisted breath and cancel the DISCONNECT Alarm. A ventilator-generated controlled breath will also cause the DISCONNECT Alarm to cancel. The INSPIRATION/EXHALATION Indicator will continue to toggle during the inspiratory and expiratory cycles of each ventilation.

- 4. If PEEP is required, repeatedly press PEEP Pushbutton Switch until desired setting appears in LCD. (See section entitled USING POSITIVE END EXPIRATORY PRESSURE for complete instructions).

- 5. Press SIGH Pushbutton Switch if SIMV operation with SIGH is required. SIGH ventilations are delivered once every 100 ventilations or 7-minutes, whichever occurs first. Each SIGH ventilation equals 150% of the INSPIRATION TIME setting, which increases delivered volume by 50%. As a safety precaution, Uni-Vent™ does not allow a SIGH breath to exceed 3-seconds.

SYNCHRONIZED INTERMITTENT MANDATORY VENTILATION (SIMV), (cont'd)

- 6. Press PLATEAU Pushbutton Switch if SIMV operation with PRESSURE PLATEAU is required. SIGH is automatically disabled (OFF) when PLATEAU is selected. PRESSURE PLATEAU limits peak airway pressure to the PLATEAU level for the duration of an inspiratory cycle. The PRESSURE PLATEAU value is automatically referenced 10 cmH_2O below the HIGH PRESSURE ALARM/PEAK INSPIRATORY PRESSURE RELIEF Control setting (see section entitled USING PRESSURE PLATEAU).

CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP)

CPAP operation is similar to SIMV with PEEP, except the mandatory rate is "zero". There are no assisted ventilations. The VENTILATOR RATE BECOMES "zero" and its setpoint indicator blanks. CPAP permits the patient to breathe spontaneously with PEEP. Each spontaneous breath causes a negative pressure deflection. When the trigger point is reached (2.0 cmH_2O below end pressure), Uni-Vent™ causes gas to flow at a default rate of 60 LPM until a back pressure of PEEP +5 cmH_2O is sensed (unconditional end-of-inspiration) or, 3-seconds have elapsed (time out), whichever occurs first. The Spontaneous Flow rate can be changed to a lesser flow rate, for current use, until operating power is turned OFF (see section entitled USER PROGRAMS, SET SPONTANEOUS FLOW). FIO_2 is equal to the AIR/OXYGEN MIXER setpoint. PRESSURE PLATEAU and SIGH are disabled (OFF) during CPAP operation.

An APNEA Alarm activates when there is no spontaneous breathing for 10-seconds (based on a 30-second moving average). If the spontaneous breathing rate falls to 6 BPM (or less), control ventilation during APNEA will begin (see section entitled CONTROL VENTILATION DURING APNEA; *APNEA DURING CPAP OPERATION*).

CONTROL VENTILATION DURING APNEA

When apnea is detected during ACV, SIMV, or CPAP operation, Uni-Vent™'s microprocessor generates an APNEA Alarm and initiates controlled ventilation breathing to protect your patient. Control settings that were displayed prior to APNEA will remain displayed, but ignored, during these CONTROL VENTILATIONS.

APNEA DURING ACV OR SIMV OPERATION: Controlled ventilation occurs when the period between positive and/or negative pressure deflections (spontaneous and/or Uni-Vent generated ventilations) exceeds 19-seconds minus INSPIRATION TIME setting. Monitoring for APNEA is disabled during an INVERSE I:E Alarm. Uni-Vent™ will provide your patient, from the following two alternatives, the one which offers the highest ventilation rate.

- 1. Control panel settings for VENTILATION RATE, INSPIRATION TIME and TIDAL VOLUME or;
- 2. A default VENTILATION RATE of 12 ventilations per minute and the control panel INSPIRATION TIME and TIDAL VOLUME Control settings.

NOTE: To prevent a potential lockout of the APNEA backup, Eagle™ will create a 1:2 I:E Ratio at the onset of APNEA if its current Inspiratory Time setting would result in an Inverse I:E condition.

APNEA DURING CPAP OPERATION: Controlled ventilation occurs when no spontaneous breathing is detected for 10-seconds. Controlled ventilations will have the following characteristics:

Mechanical rate = 12 breaths per minute

I:E ratio = 1:2

Tidal Volume = Will vary with patient. Uni-Vent™ will deliver gas at a flow rate of 30 liters per minute until a peak inspiratory pressure of 40 cmH_2O is reached.

Depressing the ALARM MUTE/CANCEL Pushbutton Switch cancels the APNEA Alarm, stops CONTROL VENTILATION DURING APNEA and restarts ACV, SIMV or CPAP operation to current control panel settings.

USING POSITIVE END EXPIRATORY PRESSURE (PEEP)

The Model 754/754M is capable of internally controlling PEEP. A separate PEEP valve is not required and must not be added to the disposable patient circuit. The PEEP function provides a means of converting the transducer calibration pressure reference from atmospheric pressure to atmospheric pressure + PEEP pressure. PEEP may be used during ACV, SIMV, or CPAP operation.

When the ventilator is turned ON, PEEP has a default value of 0 (OFF). A PEEP value can be manually entered using the PEEP OFF/ON-SET Pushbutton Switch. To set a value of PEEP, simply press the PEEP OFF/ON-SET Pushbutton Switch. Each time this switch is pressed, the value of PEEP will increase by 1 cmH_2O. A maximum PEEP value of 20 cmH_2O is possible. Pressing the PEEP OFF/ON-SET Pushbutton Switch when a current value of 20 exists, returns the value to 0. The PEEP setpoint value can be made to scroll upwards by putting continuous pressure on the PEEP OFF/ON-SET Pushbutton Switch until the desired value is reached.

Default trigger sensitivity is referenced to end pressure and will trigger between 1.5 to 2.0 cmH_2O below the end pressure value (see section entitled USER PROGRAMS).

Uni-Vent™'s CPU monitors PEEP. If PEEP pressure attempts to rise during its plateau, Uni-Vent™ causes the exhalation valve to open, allowing pressure to fall to zero. Should an inspiration cycle begin before end pressure plateaus, a HIGH PEEP alarm will sound.

The airway pressure waveform displayed in the LCD is an accurate representation of proximal airway pressure. Large expiratory pressure changes that occur within a short period of time create temporary pressure gradients between the patient's lungs and the proximal airway pressure sensor. Unless PEEP is used, this condition is not apparent because equalization of positive pressures does not occur with a "zero" baseline. Compliance and resistance effect exhalation time. Patient's with higher airway resistance will momentarily alter the exhalation waveform appearance by causing a greater pressure differential between the lungs and ventilator circuit. Uni-Vent™'s PEEP circuitry and software attempt to learn the patient's expiratory characteristic. Learning is an ongoing process and fine adjustments can be made to each breath as required. By doing so, pressure "undershoot" caused by gradient differences is minimized, or eliminated altogether. The initial learning process typically takes from 1 to 6 breaths. During this process, a temporary PEEP "baseline" is established for each breath so that triggering sensitivity is not decreased.

The LCD display area for PEEP is on the top line, immediately below its respective pushbutton switch. The PEEP OFF/ON-SET display will blank when a SYSTEM FAILURE Alarm occurs.

USING PRESSURE PLATEAU

When the ventilator is turned ON, PLATEAU is OFF (its default value). It becomes operable, only in the ACV and SIMV operating modes, by pressing the PRESSURE PLATEAU OFF/ON Pushbutton Switch. The PLATEAU value is automatically referenced 10 cmH_2O below the HIGH PRESSURE ALARM/PEAK INSPIRATORY PRESSURE RELIEF Control setpoint. PRESSURE PLATEAU has an absolute range of 5 to 90 cmH_2O.

When a PLATEAU value is reached, gas flow is alternately cycled OFF and ON, to maintain the PLATEAU, until the inspiratory cycle is completed. If inspiratory pressure attempts to rise above the HIGH PRESSURE ALARM/PEAK INSPIRATORY PRESSURE RELIEF Control setting, Uni-Vent™ will open the exhalation valve until pressure falls to the PLATEAU level. If Uni-Vent™ detects a leak in its disposable patient circuit, or any of its connections, additional gas flow is allowed to maintain the PLATEAU.

The LCD display area for PRESSURE PLATEAU is on the top line, immediately below its respective pushbutton switch. The PRESSURE PLATEAU display will blank when a SYSTEM FAILURE Alarm occurs.

BACKUP VENTILATOR

Eagle™ contains a backup ventilator that is designed to provide a limited degree of operation should a CPU failure occur. A CPU failure is a hardware-detected computer failure that will trigger a SYSTEM FAILURE Alarm. Normal operation will stop, the LCD will blank, the ALARM LED illuminates (flashing), the SYSTEM FAILURE LED illuminates (non-flashing) and a pulsing tone is heard. A SYSTEM FAILURE, that is caused by a CPU failure, will illuminate the SYSTEM FAILURE LED because the causing condition cannot assure safe operation of the primary Eagle™ ventilator. In such cases, a separate ventilator circuit embedded within the Eagle™, begins automatic operation. Its operating characteristics are as follows:

Rate:	12 Breaths Per Minute
I:E Ratio:	1:2 (1.67-seconds x 3.33-seconds)
Flow Rate:	30 Liters Per Minute for duration of Inspiratory Time or until Peak Inspiratory Pressure threshold is reached
Peak Inspiratory Pressure Relief:	40 cmH_2O
Gas Source Prioritization:	External Air, if available; or Internal Compressor, if operable; or External Oxygen, if available
Audible System Failure Alarm Mute/Cancel:	Pressing ALARM MUTE/CANCEL pushbutton switch cancels audible alarm
Manual Trigger Override:	Yes, followed by a 6-second reset period before automatic ventilation resumes

NOTE

A SYSTEM FAILURE that is caused by patient circuit pressure exceeding 40 cmH_2O for 5-seconds, continuously, will not cause the BACKUP VENTILATOR to activate. Instead, the ALARM LED illuminates (flashing), the SYSTEM FAILURE LED illuminates (non-flashing), a non-mutable continuous tone is heard, and the patient circuit exhalation valve is latched open-to-atmosphere.

HUMIDIFIERS AND HEAT MOISTURE EXCHANGERS (HME'S)

The Model 754/754M may be operated with a humidifier or heat moisture exchanger. Humidifiers should be connected and operated in accordance with directions provided by its manufacturer. Humidifiers are not recommended for use in transport. Observe all safety and cautionary statements.

HME's, sometimes referred to as "artificial noses", are not position-sensitive, and are recommended for transport applications. While HME's may not be suitable for all applications, they facilitate portability in a way that conventional humidifiers cannot. Choose an HME carefully. Look for one that is lightweight and has minimal dead-space and minimal resistance to flow. HME's attach between the disposable ventilator circuit and patient's endotracheal tube.

OPERATOR PERFORMANCE CHECKS

Before placing this instrument into operation, the operator can perform various operational checks to insure proper performance.

OPERATOR PERFORMANCE CHECKS, (cont'd)

- 1. Verify operating power selections.
- 2. When using external power source (from Universal AC Power Supply, or 12 VDC Power Cable) insure that LCD display verifies presence of external power and fuses are not blown or missing.
- 3. Verify successful completion of SELF-CHECK.
- 4. Insure that all hoses, tubing and fittings are properly connected.

ALARM FUNCTIONS

Uni-Vent™ contains numerous alarm circuits, designed to alert attendant personnel and protect the patient. Alarm messages appear in a dedicated area of the LCD display. This area is called the ALARM MESSAGE CENTER (AMC).

AMC is the centralized location for alarm information. It consists of a 4-line display area. Each alarm may be displayed with a short, accompanying message (two lines maximum); or simply as an alarm announcement that consists only of the alarm name. The number of simultaneous alarms determines how alarm information is displayed.

The AMC will display one alarm with accompanying message; or two simultaneously occurring alarms with respective messages. The first occurring alarm (name and message), occupies AMC's top two lines. If a second alarm occurs while the first alarm is still unresolved, its name and message occupies the AMC's third and fourth lines. If three or more alarms become active simultaneously, the AMC reverts to showing each alarm by name only. There are no accompanying messages. When more than four alarms occur simultaneously, the words "LOW/FAIL" are blanked from the BATTERY, O_2 and EXT AIR alarm names.

When there are two alarms with messages displayed in the AMC and one becomes resolved, the remaining alarm with message will occupy lines one and two.

When three alarm names are displayed in the AMC and one alarm becomes resolved, the AMC reverts to displaying the two remaining alarms with their respective messages.

Normally, each and every alarm is displayed in the LCD. However, a CPU problem will trigger a SYSTEM FAILURE that causes normal operation to stop and the LCD to blank. A SYSTEM FAILURE LED illuminates whenever a SYSTEM FAILURE alarm condition occurs. It is accompanied by a continuous, non-mutable tone. The SYSTEM FAILURE LED illuminates because the ALARM LED and LCD are rendered inoperable by the SYSTEM FAILURE. The ALARM Indicator LED illuminates whenever an alarm causing condition, other than SYSTEM FAILURE, occurs. It provides a supplemental alert when operating in a high noise environment or from a distance that might make LCD readability difficult. A pulsing audible signal accompanies each alarm.

Alarm conditions, depending upon type, may be temporarily muted or cancelled. Alarms are categorized as OPERATING, NON-OPERATING, or ADVISORY. An Operating Alarm may be muted successively and allows continued operation. Mutable alarms will reset automatically when the alarm condition is no longer valid. Non-operating alarms cannot be muted and do not allow operation to begin/continue. Advisory alarms permit continued operation and can be muted once. AMC display of Advisory Alarms blank if a non-operating alarm occurs or, more than four Operating Alarms are simultaneously active. A description of each alarm follows:

OPERATING ALARMS

BATTERY LOW/FAIL Alarm: The BATTERY LOW/FAIL Alarm activates when 30-minutes of operating time remains. As Uni-Vent™ approaches its failing voltage, it will generate alerting sounds from its alarm buzzer. At the failing voltage a SYSTEM FAILURE ALARM occurs just prior to shutdown. When activated the AMC displays: BATTERY LOW/FAIL - RECHARGE/REPLACE BATTERY PACK, BATTERY LOW/FAIL or BATTERY. The AMC will blank if a non-operating alarm occurs.

WARNING

The BATTERY LOW Alarm activates based on CPU assessment of current consumption. The user is cautioned to be aware that battery power will consume faster when the internal compressor is used.

WARNING

When a BATTERY LOW Alarm occurs during internal compressor and external oxygen use, the CPU will instruct the external oxygen supply to provide full tidal volume (at 100% FIO_2) to prolong battery life. An FIO_2 Alarm will be generated. It can be cancelled by turning the AIR/OXYGEN MIXER Control setpoint to 100%.

OPERATING ALARMS, (cont'd)

EXTERNAL POWER LOW Alarm: The EXTERNAL POWER LOW Alarm activates when Uni-Vent™ senses an external power source voltage less than 10.9 VDC at the External Power Input Jack. When activated the AMC displays: EXTERNAL POWER LOW - CHECK POWER SOURCE/CONNECTIONS or EXT PWR. The AMC will blank if a non-operating alarm occurs.

LOW PRESSURE Alarm: Initiates when PIP fails to exceed the LOW PRESSURE ALARM setpoint for two consecutive breaths and causes its LCD setpoint indicator, and DIGITAL BAR GRAPH setpoint indicator, to blink. When activated the AMC displays: LOW PRESSURE - PEAK INSPIRATORY PRESSURE TOO LOW or LOW PRESSURE. The AMC will blank if a non- operating alarm occurs. The LOW AIRWAY PRESSURE Alarm setpoint indicator adjacent to the DIGITAL BAR GRAPH will alternately blink, with the HIGH PRESSURE Alarm Control LCD setpoint indicator, during a PRESSURE ALARM SETTINGS Alarm.

DISCONNECT Alarm: Initiates when a disconnect is sensed in the patient circuit. When activated the AMC displays: DISCONNECT - CHECK CIRCUIT CONNECTIONS or DISCONNECT. The AMC will blank if a non-operating alarm occurs. If a DISCONNECT Alarm occurs during a LOW PRESSURE Alarm, both alarm messages will appear in the AMC. If a DISCONNECT Alarm occurs first, the LOW PRESSURE Alarm is disabled. DISCONNECT Alarm is armed in all operating modes, however, its activating conditions are different:

ASSIST-CONTROL & SIMV modes - The microprocessor looks for a positive pressure rise of at least 3 cmH_2O to occur within 75% of the INSPIRATION TIME Control setting (applies only to ventilator-generated breaths). If a positive pressure rise does not occur within this period, the DISCONNECT Alarm activates.

ASSIST-CONTROL & SIMV modes - The microprocessor alarm circuit activates when respiration's (spontaneous and/or Uni-Vent™ generated) are undetected for a period that is equal to 19-seconds minus INSPIRATORY TIME (range = 16.0 to 18.9 seconds); or *CPAP mode* - when no spontaneous breathing is detected for 10-seconds (based on a 30-second moving average). To qualify the alarm condition as DISCONNECT, or APNEA, the microprocessor delivers a controlled ventilation at the INSPIRATION TIME setting. If a pressure rise of at least 3 cmH_2O occurs within 75% of the INSPIRATION TIME Control setting (1-second when in CPAP mode), the APNEA Alarm is activated. If a pressure rise is not detected, Uni-Vent™ returns to its respective mode and activates its DISCONNECT Alarm. Should no change in status occur, the controlled ventilation test is repeated every 30-seconds.

HIGH PRESSURE Alarm: The HIGH PRESSURE Alarm activates when the patient's airway pressure exceeds the HIGH AIRWAY PRESSURE ALARM Control setting for 2-seconds (continuous), or 250-milliseconds for four (4) consecutive ventilations.

The HIGH PRESSURE Alarm setting is also the safety setting for Peak Inspiratory Pressure Relief. Excessive flows and/or inspiration times, occlusion of the patient circuit or a change in the patients physiological condition can cause a rise in peak inspiratory pressure (PIP). To safeguard the patient from high PIP, Uni-Vent™ compares PIP against the HIGH AIRWAY PRESSURE ALARM Control setting.

When a high PIP condition occurs (exceeding the HIGH AIRWAY PRESSURE ALARM Control setting by 1 cmH_2O), Uni-Vent™ causes the disposable ventilator circuit exhalation valve to open. This allows excess pressure to "dump" through the exhalation valve to atmosphere, while allowing the INSPIRATION TIME cycle to continue. When the patient circuit pressure falls below the trigger point (1 cmH_2O below the HIGH PRESSURE ALARM Control setting), the exhalation valve is closed and gas flow is allowed to resume for the remainder of the inspiratory cycle.

The HIGH PRESSURE Alarm initiates when PIP exceeds the HIGH PRESSURE Alarm setpoint for four consecutive breaths, or 2-seconds continuously, and causes its LCD setpoint indicator, and DIGITAL BAR GRAPH setpoint indicator, to blink. When activated the AMC displays: HIGH PRESSURE - PEAK INSPIRATORY PRESSURE TOO HIGH or HIGH PRESSURE. The AMC will blank if a non-operating alarm occurs. The HIGH AIRWAY PRESSURE Alarm setpoint indicator adjacent to the DIGITAL BAR GRAPH will alternately blink, with the LOW PRESSURE Alarm Control LCD setpoint indicator, during a PRESSURE ALARM SETTINGS Alarm.

OPERATING ALARMS, (cont'd)

APNEA Alarm: The APNEA Alarm is functional in the ACV, SIMV and CPAP modes. When activated in ACV or SIMV, the AMC displays: APNEA - CHECK PATIENT FOR SPONTANEOUS BREATHING or APNEA. When activated in CPAP, the AMC displays: APNEA - CPAP AVERAGE RATE LESS THAN 6-BPM or APNEA. The AMC will blank if a non-operating alarm occurs.

APNEA ALARM DURING ACV OR SIMV OPERATION: The APNEA Alarm activates when the period between positive and/or negative pressure deflections (spontaneous and/or Uni-Vent™ generated respiration's) exceeds 19-seconds minus the INSPIRATION TIME setting.

APNEA ALARM DURING CPAP OPERATION: The APNEA Alarm activates when no spontaneous breathing is detected for 10-seconds (based on a 30-second moving average).

HIGH PEEP Alarm: This alarm is disabled when the PEEP OFF/ON-SET Pushbutton Switch is set to "0". Initiates when the inspiratory cycle begins before end expiratory pressure plateaus. When activated the AMC displays: HIGH PEEP - INSPIRATION BEGAN BEFORE END PRESSURE PLATEAU or HIGH PEEP, and the PEEP OFF/ON-SET LCD display area will alternately flash. The AMC will blank if a non-operating alarm occurs.

O_2 LOW/FAIL Alarm: Initiates when a pressure less than 35-PSI (+/- 2-PSI) is sensed from an external oxygen supply. If gas mixing, or 100% oxygen, was chosen, the FIO_2 Alarm will also sound, and the CPU will terminate the oxygen source. EXTERNAL AIR (if connected), or the internal compressor, will provide the tidal volume requirement (see Note below). The O_2 LOW/FAIL Alarm can be cancelled by setting the AIR/OXYGEN MIXER setpoint to 21% or, restoring the oxygen source pressure to greater than 45-PSI (+/- 2-PSI). When activated the AMC displays: O_2 LOW/FAIL - CHECK OXYGEN SOURCE/CONNECTIONS, O2 LOW/FAIL, or O_2. The AMC will blank if a non-operating alarm occurs.

EXT AIR LOW/FAIL Alarm: Initiates when a pressure less than 35-PSI (+/- 2-PSI) is sensed from an external source of compressed air and causes the EXTERNAL AIR OFF/ON LCD indicator to blink. If the AIR/OXYGEN MIXER setpoint is greater than 21%, an FIO_2 Alarm is momentarily generated as additional oxygen flow is used to make up the air deficit contribution to tidal volume. Uni-Vent™'s CPU terminates the EXTERNAL AIR source, and activates the internal compressor, canceling the FIO_2 Alarm (see Note below). The EXTERNAL AIR LOW/FAIL Alarm can be cancelled by pressing the EXTERNAL AIR Pushbutton Switch to "OFF" which cancels the alarm or, restoring the EXTERNAL AIR source to a pressure to greater than 45-PSI (+/- 2-PSI). When activated the AMC displays: EXT AIR LOW/FAIL - CHECK AIR SOURCE/CONNECTIONS, EXT AIR LOW/FAIL or EXT AIR. The AMC will blank if a non-operating alarm occurs.

FIO_2 Alarm: Initiates when the oxygen component, or the air component, of the AIR/OXYGEN MIXER is unable to meet its proportion of the gas mixture. If the alarm is caused by an EXT AIR LOW/FAIL condition, the CPU terminates the EXTERNAL AIR source, and activates its internal compressor, canceling the FIO_2 Alarm (see Note below). The EXTERNAL AIR LOW/FAIL Alarm remains, and the EXTERNAL AIR Pushbutton Switch LCD indicator continues blinking. The alarm is cancelled when the EXTERNAL AIR Pushbutton Switch is pressed to "OFF". When activated the AMC displays: FIO_2 - GAS MIX ERROR. CHECK SOURCE/SETTINGS/CONNECTIONS or FIO_2. The AMC will blank if a non-operating alarm occurs.

NOTE

When switching between gas sources, a V_T Alarm may occur on the first transition-breath. This alarm will self-cancel on the second breath and is due to monitoring software adjustments that occur when a gas source change is invoked (manually or automatically).

PRESSURE ALARM SETTINGS Alarm: Initiates when the HIGH PRESSURE ALARM and LOW PRESSURE ALARM setpoints are reversed (i.e.: low setpoint is set higher than the high setpoint). Both Control setpoint indicators, and both indicators adjacent to the DIGITAL BAR GRAPH, alternately blink during a PRESSURE ALARM SETTINGS Alarm. When activated the AMC displays: PRESSURE ALARM SETTINGS - ALARM SETTINGS REVERSED or PRESSURE ALARM SETTINGS. The AMC will blank if a non- operating alarm occurs.

OPERATING ALARMS, (cont'd)

V_T Alarm: Initiates when delivered tidal volume is not within 10% of set tidal volume. Its usable range is from 100 to 3000ml. When activated, the TIDAL VOLUME display will alternately flash the "#### set" and "#### del" volumes; the AMC displays: V_T - DELIVERED TIDAL VOLUME DOES NOT EQUAL SET TIDAL VOLUME or V_T. The AMC will blank in the CPAP mode, or if a non- operating alarm occurs. A momentary V_T Alarm may occur when adjustments to control settings causes a large change in V_T. This alarm will self-cancel on the second breath as monitoring software makes adjustments.

COMP Alarm: Initiates when the compressor output exceeds +/-30% of its intended contribution to tidal volume for 3-consecutive breaths (the compressor alarm monitoring range requires a total tidal volume of at least 200ml {sum of all gases if FIO_2 is greater than 21%} with the compressor delivering a flow rate of at least 10 LPM). If the alarm occurs during operation with external oxygen, Uni-Vent™'s CPU instructs the oxygen source to make up for any tidal volume deficit caused by the compressor. When this occurs, an FIO_2 Alarm is generated. If EXTERNAL AIR is connected but not in use, Uni-Vent™'s CPU instructs the EXTERNAL AIR source to take over for the internal compressor (pressing the MUTE/CANCEL Pushbutton Switch cancels the COMP Alarm). If the alarm occurs and no external air or oxygen source is connected, a TIDAL VOLUME Alarm is generated, and the TIDAL VOLUME display will alternately flash the "#### set" and "#### del" volumes. This will last momentarily because a VENTILATOR FAIL Alarm (CODE 2 or CODE 3), will cause operation to cease. The AMC displays: COMP - COMPRESSOR OUTPUT LOW/FAIL or COMP. The AMC will blank if a non- operating alarm occurs.

NON-OPERATING ALARMS

INVERSE I:E Alarm: The INVERSE I:E Alarm occurs when the INSPIRATION TIME Control is set for a period that is longer than the exhalation period. Correct by lowering the RATE Control setting or lowering the INSPIRATION TIME Control setting (or both).

When INVERSE I:E occurs, an audible tone is heard, Uni-Vent™'s CPU will cause the disposable ventilator circuit exhalation valve to open to atmosphere (antiasphyxia condition), the INSPIRATION TIME/I:E RATIO Display will blink, and the AMC displays: INVERSE I:E-INSPIRATORY TIME LONGER THAN EXHALATION TIME or INVERSE I:E. The AMC will blank in the CPAP mode, or if a SYSTEM FAILURE Alarm occurs. Apnea monitoring is disabled during an INVERSE I:E Alarm.

TRANSDUCER CALIBRATION ABORT Alarm: The TRANSDUCER CALIBRATION ABORT Alarm activates when the TRANSDUCER CALIBRATION procedure is stopped prematurely. When activated, an audible tone is heard and the AMC displays: TRANSDUCER CALIBRATION ABORT-RECALIBRATE TRANSDUCER or TRANSDUCER CALIBRATION ABORT. The AMC will blank if a SYSTEM FAILURE Alarm occurs. The TRANSDUCER CALIBRATION ABORT Alarm will reset itself when recalibration is performed.

SYSTEM FAILURE Alarm: The SYSTEM FAILURE Alarm activates when Uni-Vent™'s CPU is forced to shutdown normal operation or a CPU failure has occurred. This alarm is usually related to a hardware problem. It will cause the LCD to blank, and the SYSTEM FAILURE LED to illuminate.

VENTILATOR FAIL Alarm: Initiates when any one of seven ventilator failure-causing conditions occur: Self-Check Failure, No Gas and Compressor Failure, Excessive Airway Pressure, Memory Check Failure, Exhalation Valve Failure, Excessive Negative Pressure, or Run-Time Calibration Failure. These conditions will not cause the LCD to blank and some may be operator correctable. Messages will appear in the AMC (see below). A VENTILATOR FAIL Alarm will not cause the SYSTEM FAIL LED to illuminate.

SELF-TEST FAILURE: Occurs when the ventilator fails to successfully complete SELF-CHECK. The AMC will display:

TRANSDUCER CALIBRATION - CALIBRATE TRANSDUCER VENTILATOR FAILURE DETECTED FAILURE CODE 1 • SELF-CHECK FAILURE!	- OR - if SELF-CHECK Alarm is not related to the Transducer Calibration:	VENTILATOR FAILURE DETECTED FAILURE CODE 1 • SELF-CHECK FAILURE!

NON-OPERATING ALARMS (cont'd)

NO GAS AND COMPRESSOR FAILURE: Occurs when the internal compressor has failed and no external gas(es) are available. The AMC will display:

VENTILATOR FAILURE
DETECTED

FAILURE CODE 2
- NO GAS AND COMPRESSOR FAILURE!

EXCESSIVE AIRWAY PRESSURE: Occurs when a continuous pressure, above 100 cmH_2O, is sensed in the patient circuit for more than 2-seconds. Uni-Vent™ must be turned OFF, then restarted, to clear a SYSTEM FAILURE Alarm caused by high pressure. The AMC will display:

VENTILATOR FAILURE
DETECTED

FAILURE CODE 3
- EXCESSIVE AIRWAY PRESSURE!

MEMORY CHECK FAILURE: Occurs when the MEMORY CHECK portion of SELF-CHECK fails. The AMC will display:

VENTILATOR FAILURE
DETECTED

FAILURE CODE 4
- MEMORY CHECK FAILURE!

EXHALATION VALVE FAILURE: Occurs when a failure of the exhalation backup solenoid is sensed. The AMC will display:

VENTILATOR FAILURE
DETECTED

FAILURE CODE 5
- EXHALATION VALVE FAILURE!

EXCESSIVE NEGATIVE PRESSURE: Occurs when a continuous negative pressure exceeding -10 cmH_2O for 1.5-seconds is sensed.

VENTILATOR FAILURE
DETECTED

FAILURE CODE 6
- EXCESSIVE NEGATIVE PRESSURE!

RUN-TIME CALIBRATION FAILURE: Occurs when Eagle™'s pressure transducer AUTO CAL function detects excessive baseline shift.

VENTILATOR FAILURE
DETECTED

FAILURE CODE 7
- RUN-TIME CALIBRATION FAILURE!

ADVISORY ALARMS

INSPIRATION TIME TRUNCATED TO 3-SEC Alarm: Initiates when control settings would cause an inspiration time to exceed 3-seconds. It is disabled in the CPAP mode. When activated, operation is allowed to continue, an audible tone is heard and the AMC displays: INSPIRATION TIME TRUNCATED TO 3-SEC-NOTE I-TIME & I:E or INSPIRATION TIME TRUNCATED. The AMC will blank if a non-operating alarm occurs. Otherwise, pressing the ALARM MUTE/CANCEL Pushbutton Switch cancels this alarm's audible component, and turns the ALARM LED off. Only the AMC message remains. A SIGH breath that would exceed 3.0-seconds is truncated but will not activate this alarm.

PLATEAU VOLUME Alarm: Initiates when delivered PRESSURE PLATEAU tidal volume is less than set tidal volume by more than 5%. When activated, operation is allowed to continue, an audible tone is heard and the AMC displays: PLATEAU VOLUME-DELIVERED VOLUME LESS THAN SET VOLUME or PLATEAU VOLUME. The TIDAL VOLUME LCD Display will flash "#### set" volume (delivered volume is not displayed), and V_{min} is blanked (ACV mode). The AMC will blank in the CPAP mode, or if a non-operating alarm occurs. Pressing the ALARM MUTE/CANCEL Pushbutton Switch cancels this alarm's audible component, and turns the ALARM LED off. Only the AMC message and alternating display remain. This alarm replaces the V_T Alarm during PRESSURE PLATEAU operation. It is disabled when CPAP operation is selected.

V_T SETTINGS Alarm: Initiates whenever the sum of the flows of the selected gases would exceed a flow rate of 60 liters per minute (LPM). When activated the AMC displays: V_T SETTINGS - I-TIME X FLOW UNABLE TO DELIVER SET VOLUME or V_T SETTINGS. The TIDAL VOLUME LCD Display will alternately flash "#### set" and "#### del". The AMC will blank in the CPAP mode, or if a non-operating alarm occurs. Pressing the ALARM MUTE/CANCEL Pushbutton Switch cancels this alarm's audible component, and turns the ALARM LED off. Only the AMC message and alternating display remain.

PREVENTATIVE MAINTENANCE Alarm: Initiates after 2000-hours of cumulative use, or 12-months, whichever occurs first. Preventative maintenance will insure that this device has been cleaned, tested, calibrated, and serviced to manufacturers specifications (see LIMITED WARRANTY statement). When activated the AMC displays: PREVENTATIVE MAINTENANCE DUE - CONTACT CUSTOMER SERVICE or PREVENTATIVE MAINTENANCE DUE. The AMC will blank if a non-operating alarm occurs. Pressing the ALARM MUTE/CANCEL Pushbutton Switch cancels this alarm's audible component, and turns the ALARM LED off. Only the AMC message remains.

EXTENDED NON-USE/STORAGE Alarm: Initiates at power-up after 6-months of continuous non-use/storage has occurred. Following 6-months of continuous storage/non-use, this device should be examined, operationally tested, and its batteries recharged before patient-use is attempted. Servicing may be required. Recommended maintenance checks can be found in the SERVICE section of the Model 754M Instruction Manual. Servicing should be performed by qualified personnel only. When activated the AMC displays: EXTENDED NON-USE/STORAGE - TEST BEFORE PATIENT USE or EXTENDED NON-USE/STORAGE. The AMC will blank if a non-operating alarm occurs. Pressing the ALARM MUTE/CANCEL Pushbutton Switch cancels this alarm's audible component, and turns the ALARM LED off. Only the AMC message remains.

EXTERNAL POWER FAILURE Alarm: Initiates whenever external power fails, or is disconnected during external power operation. When activated, operation reverts to internal battery power, a tone is heard, and the AMC displays: EXT PWR FAIL/DISCONNECT - CHECK POWER SOURCE/CONNECTIONS or EXT PWR FAIL/DISCONNECT. The POWER INFORMATION CENTER (PIC) will display: EXT PWR FAIL. Pressing the ALARM MUTE/CANCEL Pushbutton Switch cancels the audible alarm, and the AMC and PIC messages, and resets the ALARM LED. The AMC will blank if a non-operating alarm occurs.

TOTAL FLOW BACKUP Alarm: Initiates when the backup flow sensor detects the sum of the flows (O_2, Air, and internal compressor) exceeding set flows by +/- 50% for 5-consecutive breaths. There must be a total flow rate of at least 10 LPM and a total tidal volume of at least 200ml for this alarm to operate. When activated, operation is allowed to continue, an audible tone is heard, and the AMC displays: TOTAL FLOW BACKUP - CONTACT CUSTOMER SERVICE. The AMC will blank if a non-operating alarm occurs. Pressing the ALARM MUTE/CANCEL Pushbutton Switch cancels this alarm's audible component, and turns the ALARM LED off. Only the AMC message remains. If this alarm is not preceded by a V_T operating alarm, the causing condition is likely due to the backup flow sensing element being dirty or partially clogged.

ALARM MUTING AND CANCELLING

ALARM MUTE/CANCEL Pushbutton Switch: The ALARM MUTE/CANCEL Pushbutton Switch, deactivates the audible portion of an existing OPERATING ALARM for a 30-second period (with the exception of certain power alarm conditions). Mute periods for BATTERY Alarms last for 5-minutes. If an EXTERNAL POWER LOW Alarm occurs and is muted, the mute period will last until the internal battery depletes. At this point, a BATTERY LOW Alarm activates, in addition to the EXTERNAL POWER LOW Alarm, and muting will now last for 5-minute periods.

A new alarm condition will always override a pre-existing "mute".

The ALARM MUTE/CANCEL Pushbutton Switch will cancel an APNEA Alarm allowing Uni-Vent™ to resume operation in the ACV, SIMV or CPAP modes. Pressing the ALARM MUTE/CANCEL Pushbutton Switch does not effect the AMC display (except for the APNEA message which is cancelled).

A NON-OPERATING ALARM cannot be muted or cancelled. It will self-cancel when its causing condition is corrected.

ADVISORY ALARMS may be muted once. The mute period will continue indefinitely or until its causing condition is corrected.

ROUTINE CARE: CALIBRATION, CLEANING, AND PREVENTATIVE MAINTENANCE

CALIBRATION

This device should be incorporated into a regular preventative maintenance program to insure compliance with operating specifications. Calibration measurements should be made each year unless significant usage warrants a shorter period between preventative maintenance inspections. A complete calibration check should be made following each 2000 hours of cumulative use or 12-month period. Following 6-months of continuous storage/non-use, this device should be examined, operationally tested, and its batteries recharged before patient-use is attempted. Recommended maintenance checks can be found in the SERVICE section of the Model 754M Instruction Manual. The Model 754/754M contains internal clocks that monitor cumulative use and storage/non-use periods. Appropriate Advisory Alarm messages will appear in the Alarm Message Center when calibration/preventative maintenance is required.

A Calibration Label is affixed to the Eagle™'s exterior case. It includes the date of last calibration, the next calibration due date (based on 12-months use, however, if 2000-hours use occurs first, it shall take precedence). The LIMITED WARRANTY will become void if this label is removed or tampered with.

CLEANING

Keep Uni-Vent™ and its accessories clean at all times. Never allow grease and oil to enter the system or coat its components. Exposed parts should be dried following usage in wet environments. Users are encouraged to clean this device and its accessories at regular intervals and maintain up-to-date records of maintenance and inspections. Internal pneumatic components are sealed, thus routine maintenance is not required. Pressure hose connections should be wiped with a damp, soapy cloth and thoroughly dried with a lint-free cloth. Uni-Vent™'s housing may also be cleaned as necessary with a damp, soapy cloth and thoroughly dried with a lint-free cloth. Do not clean with abrasives or chlorinated hydrocarbon cleansers.

High Pressure Hoses: Examine hoses for cracking, discoloration and disfigurement. Wipe exterior wall with a damp, soapy cloth. Dry with a lint- free cloth. Examine end connection fittings for damaged threads and sharp edges. Replace if defective, DO NOT attempt to repair.

Compressor Inlet Filter: The compressor inlet filter housing is located to the right of the connector panel on the side edge of the bottom cover. Remove filter using a pair of tweezers or similar tool. Examine the filter for dirt, lint, or general wear. Replace if necessary. DO NOT attempt to clean this filter. Do not operate internal compressor without filter in place.

PREVENTATIVE MAINTENANCE

Routine maintenance should be performed on this instrument at regular intervals and prior to its being placed into service. Routine maintenance should consist of the following:

- 1. Cleaning checks - as described above.
- 2. Operational checks - as described in OPERATOR PERFORMANCE CHECKS.
- 3. Tubing and hose checks - replaced crimped, cracked or worn tubing and hose as required.
- 4. Mechanical components have a finite life expectancy. Their cumulative wear-and-tear depends largely upon the number of cycles-during-use and their number of hours-in-use. Accordingly, this instrument should be returned to Impact, or a certified Impact Service Facility, after 2000 hours of cumulative use or 12-months, whichever occurs first, to insure its continued operation to specifications (see LIMITED WARRANTY statement).

Contact Impact prior to returning this instrument for scheduled maintenance or service. A Returned-Goods-Authorization number (RGA #) will be issued. The RGA number must appear on both the packing slip and address label. This will facilitate better tracking of returned items, and result in improved scheduling and handling.

BATTERY CARE AND RECHARGING

The Uni-Vent™ Model 754/754M uses sealed lead-acid batteries, "starved-electrolyte" type, which offer a wide temperature operating range, do not exhibit "memory" characteristics (reduced capacity) or vent hydrogen gas. The life of these batteries depends, to a great extent, upon the care they receive. Following these simple guidelines will prevent premature charge depletion and reduction of battery life.

1. DO NOT operate this instrument where the temperature range exceeds -60°C to 60°C (-76°F to 140°F).

2. DO NOT charge this instrument where the temperature range exceeds -20°C to 50°C (-4°F to 122°F).

3. DO NOT store this instrument with the batteries discharged. Always store in a charged condition.

4. For long-term storage, the optimum storage temperature range is 10°C to 30°C (50°F to 80°F).

Sealed lead acid batteries exhibit excellent charge retention characteristics. Prolonged periods of disuse will not substantially reduce operating capability. If long-term disuse is common, it would be advisable to recharge the unit once every two months. This will insure that battery charge is maintained at 80% capacity or better. Recharge time ranges from 14 - 16 hours, depending upon initial state of discharge. Continuous charging is permissible with the 12 VDC Power Cable or Universal AC Power Supply furnished with Uni-Vent™. The EXTERNAL POWER Jack is located along the top edge of the Uni-Vent™ case. The CHARGE indicating LED will illuminate whenever charging current is flowing into the battery pack. The POWER INFORMATION CENTER (PIC) will display: (Line 1) "EXT PWR ON", and (Line 2) battery icon "ON CHG". A fully charged battery pack will cause the CHARGE LED to turn off and PIC display Line 2 changes to battery icon "OK".

Uni-Vent™ will accept a range of inputs for operating power and battery recharge purposes. Standard accessories, as mentioned in the previous paragraph, are provided. For special applications requiring non-standard accessories, the following requirements are intended to serve as guidelines:

Input Voltage:	11 to 15 VDC
DC Ground:	Negative
DC Power:	80 Watts (over the input voltage range)
AC Frequency:	Not applicable

Operating power will default to the external power source to preserve internal batteries for portable or transport use, emergency back-up or recharging purposes. If an EXTERNAL POWER LOW/FAIL Alarm occurs, Uni-Vent™ will automatically revert to its internal batteries for operating power.

IN CASE OF DIFFICULTY

Authorization to service this instrument by other than factory-trained and certified personnel will not be given, nor does Impact Instrumentation, Inc. assume any responsibility and/or liability resulting from such unauthorized servicing.

Impact will, upon request, provide competent biomedical engineering departments with service data and schematics. Such departments are encouraged to contact the factory for assistance when needed and it is recommended that staff members attend a factory training course. Details may be obtained by contacting the Impact Customer Service Department.

OPERATOR CORRECTABLE PROBLEMS

Common problems may be quickly rectified by users. Should Uni-Vent™ fail to operate properly, verify the integrity of all hose, tubing and fitting connections. Check all control panel settings. Verify that compressor inlet filter is not clogged or dirty. Check for operating power with internal batteries and external power source(s). Replace any fuse that is blown or missing. Verify successful SELF-CHECK, perform TRANSDUCER CALIBRATION if required.

OPERATOR PROBLEMS REQUIRING SERVICE

If the tests described above do not resolve an operating problem, service is required. Should servicing be necessary, contact your nearest Impact Representative or the Impact Customer Service Department 973/882-1212. A Returned-Goods-Authorization number (RGA #) will be issued. The RGA number must appear on both the packing slip and address label. This will facilitate better tracking of returned items, and result in improved scheduling and handling. Please have the Model and Serial Number ready and any other pertinent data you wish to include in the service request. Uni-Vent™'s Serial Number Label is affixed to the bottom cover.

STORAGE INFORMATION

For prolonged storage periods, the Model 754/754M should be stored indoors. The environment should be clean and out of direct sunlight. Storage in non-controlled environments is permissible if batteries are removed.

If batteries are not removed, short-term storage temperatures should range between 5°F and 104°F (-15°C to 40°C), relative humidity should be low. For long-term storage, the optimum storage temperature range is 50°F to 80°F (10°C to 30°C).

DO NOT store batteries in a discharged condition.

When batteries are in extended storage, it is recommended that they receive a refresh charge at recommended intervals:

STORAGE AMBIENT	RECHARGE INTERVAL
Below 68°F (20°C)	18-months
68° to 86°F (20° to 30°C)	12-months
86° to 104°F (30° to 40°C)	6-months

Following periods of extended storage in non-controlled environments, allow Uni-Vent™ sufficient time to stabilize to a temperature within its specified operating range (see section entitled BATTERY CARE AND RECHARGING).

The EXTENDED NON-USE/STORAGE Alarm will initiate at power-up after 6-months of continuous non-use/storage has occurred. Following 6-months of continuous storage/non-use, or longer, this device should be examined, operationally tested, and its batteries recharged before patient-use is attempted. Servicing may be required. Recommended maintenance checks can be found in the SERVICE section of the Model 754M Instruction Manual. Servicing should be performed by qualified personnel only.

SPECIFICATIONS

OPERATING MODES:	ACV - with/without PEEP, with/without SIGH
	ACV - with/without PEEP, with/without PRESSURE PLATEAU
	SIMV - with/without PEEP, with/without SIGH
	SIMV - with/without PEEP, with/without PRESSURE PLATEAU
	CPAP - with/without PEEP
	Control Ventilation - for APNEA backup of ACV, SIMV and CPAP
FLOW RATE:	Adjustable, 0 to approximately 60 LPM (0 to approximately 1000 ml/SEC)
VENTILATION RATE:	Adjustable, 1 to 150 breaths per minute, resolution 1 breath per minute (+/- 1 digit on the LCD)
INSPIRATION TIME:	Adjustable, 0.1 to 3.0 seconds, resolution in 0.1 second increments (+/- 1 digit on the LCD); 1:2 I:E RATIO Preset
FIO_2:	Adjustable, 21% to 100%, resolution in 1% increments, accurate to within +/- 10%
LOW PRESSURE ALARM:	Adjustable, 0 to 50 cmH_2O, resolution in 1 cmH_2O increments (+/- 1 digit on the LCD)
HIGH PRESSURE ALARM:	Adjustable, 15 to 100 cmH_2O, resolution in 1 cmH_2O increments (+/- 1 digit on the LCD)
PEAK INSPIRATORY PRESSURE RELIEF:	Adjustable, 15 to 100 cmH_2O, resolution in 1 cmH_2O increments (+/- 1 digit on the LCD)
PRESSURE PLATEAU:	Range, 5 to 90 cmH_2O (referenced to HIGH PRESSURE ALARM setpoint)
ASSIST/SIMV SENSITIVITY:	Default, 1.5 to 2.0 cmH_2O below end pressure (see USER PROGRAMS)
PEEP:	Program range 1 to 20 cmH_2O, resolution in 1 cmH_2O increments (+/- 1 digit on the LCD)
SIGH:	Occurs once every 100-ventilations or 7-minutes, whichever occurs first. SIGH duration = 150% of inspiration time (truncated to a combined maximum of 3-seconds)
Liquid Crystal Display:	EXTERNAL AIR, SIGH, PEEP, PRESSURE PLATEAU, HIGH PRESSURE ALARM SETTING, LOW PRESSURE ALARM SETTING, VENTILATION RATE, INSPIRATION TIME/I:E RATIO, TIDAL VOLUME, AIR/OXYGEN MIXER, MODE, INSPIRATION/EXHALATION, POWER, PEAK AIRWAY PRESSURE, MEAN AIRWAY PRESSURE, DIGITAL BAR GRAPH, HIGH/LOW, AIRWAY PRESSURE ALARM SETPOINT INDICATORS, P_{aw}

SPECIFICATIONS, (cont'd)

LED INDICATOR:	CHARGE
LCD DIGITAL BAR GRAPH:	Range -10 to 100 cmH_2O
LCD ALARM DISPLAY:	BATTERY LOW, EXTERNAL POWER LOW, LOW PRESSURE, O_2 LOW/FAIL, DISCONNECT, HIGH PRESSURE, APNEA, V_T, HIGH PEEP, EXT AIR LOW/FAIL, FIO_2, INVERSE I/E, COMP, PRESSURE ALARM SETTINGS, TRANSDUCER CALIBRATION ABORT, SYSTEM FAILURE, VENTILATOR FAIL, INSPIRATION TIME TRUNCATED TO 3-SEC, PLATEAU VOLUME, PREVENTATIVE MAINTENANCE DUE, V_T SETTINGS, EXTENDED NON-USE/STORAGE, EXTERNAL POWER FAILURE, TOTAL FLOW BACKUP
LED ALARM INDICATORS:	ALARM, SYSTEM FAILURE
ALARM VOLUME:	80 dBA @1 ft
MANUAL BREATH/TRIGGER:	Yes
NOISE LEVEL:	Less than 80 dBA when measured @1-meter (compressor operating)
OPERATING VOLTAGES:	
Ventilator:	11-15 volts, DC (negative ground)
Universal AC Power Supply:	Model 754 (standard) - Input: 90 to 265 VAC, 47-440 HZ, autosensing Model 754 (optional), Model 754M (standard) AC Input: 115/230 Volts, +/-10%; 50-400 HZ, +/-2%, autosensing DC Input: 16-30 Volts (DC-DC Converter), negative ground
OPERATING TIME:	
Internal Batteries:	3-hours, maximum, using internal compressor 12-hours using external gas
External AC:	Continuous
External DC:	Continuous
TEMPERATURE RANGES:	
OPERATING:	-60°C to 60°C (-76°F to 140°F)
CHARGING:	-20°C to 50°C (-4°F to 122°F)
LONG TERM STORAGE:	10°C to 30°C (50°F to 80°F)

SPECIFICATIONS, (cont'd)

SIZE:

Ventilation System	8.87" Wide X 11.5" High X 4.5" Deep (22.55 cm Wide X 29.21 cm High X 11.43 cm Deep)
AC Power Supply (std)	8.75" Wide X 2.25" High X 5.75" Deep (22.23 cm Wide X 5.71 cm High X 14.61
AC Power Supply (opt)	8.75" Wide X 3.63" High X 5.75" Deep (22.23 cm Wide X 9.22 cm High X 14.61 cm Deep)

WEIGHT:

Ventilation System	13 lbs (5.8 Kg)
AC Power Supply (std)	3.00 lbs (1.36 Kg)
AC Power Supply (opt)	6.75 lbs (3.07 Kg)

WARRANTY: Limited, 1-year (see LIMITED WARRANTY statement)

LIMITED WARRANTY

When used in accordance with the instructions contained within this Manual, Impact Instrumentation, Inc., warrants this instrument to be free from all defects in materials and workmanship for a period of one (1) year.

Batteries, which by their nature are consumable and subjected to environmental extremes, will be warranted only for a period of ninety (90) days. Accessories, also consumable in usage, such as connecting hose, are not warranted.

Mechanical components are subject to wear and fatigue over time. They will deteriorate quicker when continuous-use applications are involved. To insure compliance with operating specifications, it is the user's responsibility to insure that 2000 hour preventative maintenance is performed. Following each 2000 hours cumulative use, or 12-month period, whichever occurs first, this device must have preventative maintenance performed by Impact or a certified Impact service facility.

A Calibration Label is affixed to the Eagle™'s exterior case. It includes the date of last calibration, the next calibration due date (based on 12-months use, however, if 2000-hours use occurs first, it shall take precedence). This warranty shall become void if this label is removed or tampered with.

This warranty is neither assignable nor transferable, nor does it apply if this instrument is tampered with, misused or serviced by unauthorized personnel. All warranty repairs shall be subject to return postage billing.

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SECTION II. SERVICE

INTRODUCTION

The information contained herein is restricted to use by personnel trained and certified by Impact Instrumentation, Inc., or military personnel trained in the care and servicing of this product. Impact does not authorize or assume any obligations resulting from unauthorized servicing nor will it be held liable for any injuries or damages incurred therefrom.

This device has been classified "life supporting" and "life sustaining" by the United States Food & Drug Administration. If you have not been trained and certified by Impact Instrumentation, Inc., or if you are not a military person trained in the care and servicing of this product, *DO NOT* attempt to service this device.

- Impact Instrumentation will provide service training at the manufacturing site to pre-qualified users. The cost of training will depend upon the number of training days requested and the number of personnel attending. Users shall be responsible for their travel, lodging, and subsistence costs.

- Service training at user facilities is available. The cost of training will depend upon the number of training days requested. In addition, the user shall be responsible for Impact's transportation, lodging, and subsistence costs.

- The Impact service facility encourages dialogue from user service personnel towards rectifying any service related matter. All service requests may be addressed to the Service Manager, Impact Instrumentation, Inc., 27 Fairfield Place, West Caldwell, New Jersey 07006, 973/882-1212.

Should factory servicing become necessary, or technical assistance is required, please have the Model 754/754M Serial Number ready and any other pertinent data you wish to include in your service request. The Model 754/754M Serial Number is located on the outer case identification label.

CAUTIONARY NOTE

Prior to servicing this device, be aware of the presence of potentially dangerous operating voltages.

HELPFUL HINTS

Before attempting to repair/calibrate this instrument, please take a few moments to insure that the problem is not accessory-related. Check the integrity of all tubing and fittings. Verify that tubing is not crimped or cracked due to fatigue.

Refer to the schematic and assembly pictorials when trouble shooting. Isolate the problem to a functional segment of the circuitry. Always insure the integrity of circuit ground and that the correct mains voltage is present.

Always safeguard your personal well being when troubleshooting electronic circuitry. Keep jewelry and liquids from the vicinity of active circuitry.

DISASSEMBLY/REASSEMBLY

TOOLS REQUIRED

Screwdriver, Phillips Head, Small
Screwdriver, Phillips Head, Medium

Pliers, Needle Nose - Thin
Pliers, Needle Nose - Heavy
Pliers, Soft Jaw (Diamond #529-10)

Nut Driver, #4
Nut Driver, #4 (Thin Wall)
Nut Driver, #6
Nut Driver, #8

Hex Key Driver, 7/64"
Hex Key Driver, 3/16"
Hex Key Driver, #10

Ratchet Handle, 3/8"
3/8" Deep Socket
7/16" Deep Socket
5/8" Deep Socket
19mm Deep Socket
1" Deep Socket
7/16" Socket
3/4" Socket
13/16" Socket
1" Socket

Wrench, Open End, 5/16"
Wrench, Open End, 7/16"
Wrench, Open End, 1/2"
Wrench, Open End, 3/4"
Wrench, Open End, 7/8"
Wrench, Adjustable, 10"

Solder (#44 Rosin Core)
Soldering Iron
Soldering Iron (800W)

Heat Sink, (clip-on, or equivalent)
Cable Tie Installation Tool
Wire Cutter
Scissors
Razor Knife
Hemostat, Small
Heat Gun

Pana Vise
Bench Vise with smooth jaws

Foam Pad
Foam Spacer Pad

LEMO Wrench Set, 2 wrenches
(for size 2B and 3B Connectors)
LEMO Socket Wrench

The following tools are required if the servicing activity intends to perform connector repairs.

Rivet Tool (Marson HP-2 with Hole Adapters)
Crimp Tool (Panduit CTD-100F)
Hand Crimping Tool (Panduit CT-500)
Hand Crimping Tool (AMP Handle Assembly 58074-1 and Insert 58247-1)
Crimp Tool (Waldom W-HT192)

DISASSEMBLY/REASSEMBLY

GENERAL INSTRUCTIONS

Verify that Mode Selector Switch is in the OFF position.

Disconnect all hoses and cables.

Open Battery Compartment Door, disconnect Battery Pack connector, and separate Velcro® hold down straps.

Remove Battery Pack.

SEPARATING UPPER AND LOWER CASE ASSEMBLIES

A braided cable is soldered to a lug that is riveted to the Battery Compartment Door. This braid must be carefully removed in order to separate the Upper and Lower Case Assemblies from each other. To remove this braid from the lug, cut and remove enough shrink tubing to expose the braid/lug solder connection. Attach a clip-on heat sink between the solder lug and rivet to protect the Battery Compartment Door from excessive heat. Apply enough heat from a soldering iron tip to the solder connection and separate braid from lug.

Working from inside the Battery Compartment, unscrew two (2) 6-32 x 1/2 Phillips Pan Head Screws (358-0632-08) with #6 Flat Washers (376-0007-00) that connect the Upper and Lower Covers. Place Ventilator "face down", on Foam Pad (to protect clear door from scratching). Its Lower Cover is now facing upward. Unscrew six (6) 6-32 x 1/2 Phillips Pan Head Screws (358-0632-08) securing the Upper and Lower Covers. Two screws are located by the handle, two are located along the bottom edge of the Lower Cover, one is located beneath the "AIR" Inlet fitting, and one is located beneath the "OXYGEN" Inlet fitting. DO NOT unscrew the 6-32 x 1/2 Phillips Pan Head Screw (358-0632-08) that is on the bottom of the Lower Cover adjacent to the Condensed Operating Instructions Label, or the two (2) 6-32 x 1/2 Phillips Pan Head Screws (358-0632-08) that attach through the Condensed Operating Instructions Label.

Carefully stand Upper and Lower Case Assemblies with Connector Panel facing up and slowly separate the assemblies from each other. NOTE: To completely separate the Upper and Lower Case Assemblies, it will be necessary to perform the following disassembly instructions.

a. Disconnect Transducer Hose (from Red Hose Barb of Autocal Valve Assembly 704-0754-07) using small hemostat (this hose is connected to the Analog Printed Circuit Board 702-0754-02).

b. At 3-pin header on Display/Switch Panel PCB (702-0754-01), detach 3-Pin Connector coming from Filter PCB Assembly (704-0754-03).

c. At side connector on Motor Drive PCB (702-0754-05), accessible through cutout in EMI Shield (310-0754-01), detach 8-Pin Ribbon Cable (8-pins x 1-row) coming from Compressor Assembly (704-0754-05).

d. At Power PCB (702-0754-04), detach 8-Pin Cable (4-pins x 2-rows) coming from Filter PCB (704-0754-06).

e. At Analog PCB (702-0754-02) right-angled header, detach 14-Pin Ribbon Cable (7-pins x 2-rows) coming from Flow Manifold (703-0754-01).

f. At Motor Drive PCB (702-0754-05) innermost pins on PCB connector, detach 4-Pin Ribbon Cable (4-pins x 1-row) coming from Exhaust Manifold (703-0754-04).

g. At Motor Drive PCB (702-0754-05) middle pins on PCB connector, detach 2-Pin Connector coming from Autocal Valve Assembly (704-0754-07).

h. At Motor Drive PCB (702-0754-05) outermost pins on PCB connector, detach 6-Pin Ribbon Cable (6-pins x 1-row) coming from Flow Manifold (703-0754-01).

i. At hole in Display/Switch Panel PCB (702-0754-01), detach braid (with solder lug) coming from Filter PCB Assembly (704-0754-03). It is held in place with one 4-40 x 5/16 Phillips Pan Head Screw (358-0440-05) and two #4 Internal Tooth Lockwashers (376-0019-00) (a lockwasher is located on either side of the solder lug).

To reassemble, reverse the above steps. Insure that wires and tubing are not crimped or pinched between components, and the Velcro® Straps, the remaining braid, and the battery pack connector stay positioned in the battery pack "well area".

When mating the Upper Case Assembly (703-0754-06) to Lower Case Assembly (703-0754-05), make sure the Inner wall of Upper Case Assembly (703-0754-06) passes "outside" of Filter PCB (704-0754-03) and Battery Divider tabs align with holes in the Lower Case Assembly (703-0754-05).

To reattach braid to solder lug riveted to Battery Compartment Door, first apply a small piece of shrink tubing over the braid. Make sure the clip-on heat sink is attached between the solder lug and rivet. Carefully solder braid to lug. Slide shrink tubing over solder connection, then shrink tubing with Heat Gun.

UPPER CASE ASSEMBLY

The Upper Case Assembly (703-0754-06) consists of the following essential elements: an EMI Shield (attached during Final Mechanical Assembly) surrounding the printed circuit board "stack", five (5) printed circuit board assemblies, a Front Panel, a Top Cover, a Battery Compartment Door, a Battery Compartment Divider, and a Top Cover Door.

To disassemble, lay Upper Case Assembly "face down" on Foam Pad (to protect clear door from scratching).

Looking at the "face down" Assembly, the printed circuit board (PCB) "stack" is mechanically attached in the following order: Power PCB to Motor Drive PCB to Analog PCB to CPU PCB to Display/Switch Panel PCB.

1. Remove Elbow with 2" Tygon Hose from the ½" Tygon Hose (that connects to the pressure transducer located on the Analog PCB). Detach EMI Shield (with Grommets) from Upper Case Assembly (703-0754-06) by unscrewing two 4-40 x 5/16 Phillips Pan Head Screws (358-0440-05) and two #4 Internal Tooth Lockwashers (376-0019-00).

2. Disconnect 2-Pin Connector from Display/Switch Panel PCB (702-0754-01) to Power PCB (702-0754-04).

3. Separate Power PCB (702-0754-04) from Motor Drive PCB (702-0754-05) by removing five 4-40 Keps Nuts (346-0440-01).

4. Separate Motor Drive PCB (702-0754-05) from Analog PCB (702-0754-02) by removing four 4-40 x 3/8 Male-to-Female Spacers (368-0029-00).

5. Remove 4-40 x 3/8 Male-to-Female Spacer (368-0029-00) on Motor Drive PCB (702-0754-05) by unscrewing 4-40 x 1/4 Phillips Pan Head Screw (358-0440-04).

6. Separate Analog PCB (702-0754-02) from CPU PCB (702-0754-03) by removing four 4-40 x 1/2 Male-to-Female Spacers (368-0028-00).

7. Separate CPU PCB (702-0754-03) from Display/Switch Panel PCB (702-0754-01) by removing four 4-40 x 1/2 Male-to-Female Spacers (368-0028-00).

   NOTE: The following disassembly SHOULD NOT be performed unless repairs to the Display/Switch Panel PCB (702-0754-01) are necessary.

8. Turn Assembly "face up" and set on Foam Pad. Open Clear Door. Remove skirts (392-0030-00 and 392-0031-00), knobs (392-0024-00 and 392-0025-00), and caps (392-0027-00 and 392-0028-00) from Potentiometer Controls and Mode Control Switch. Caps can be pried off, using Wire Cutters or a thin flat blade. Collet knobs can be removed by loosening the screw that becomes exposed once the cap is removed.

9. Remove hex nut securing Mode Control Switch to Front Panel (422-0754-11).

10. Remove nut and lockwasher securing all Potentiometer Controls (six total) to Front Panel (422-0754-11).

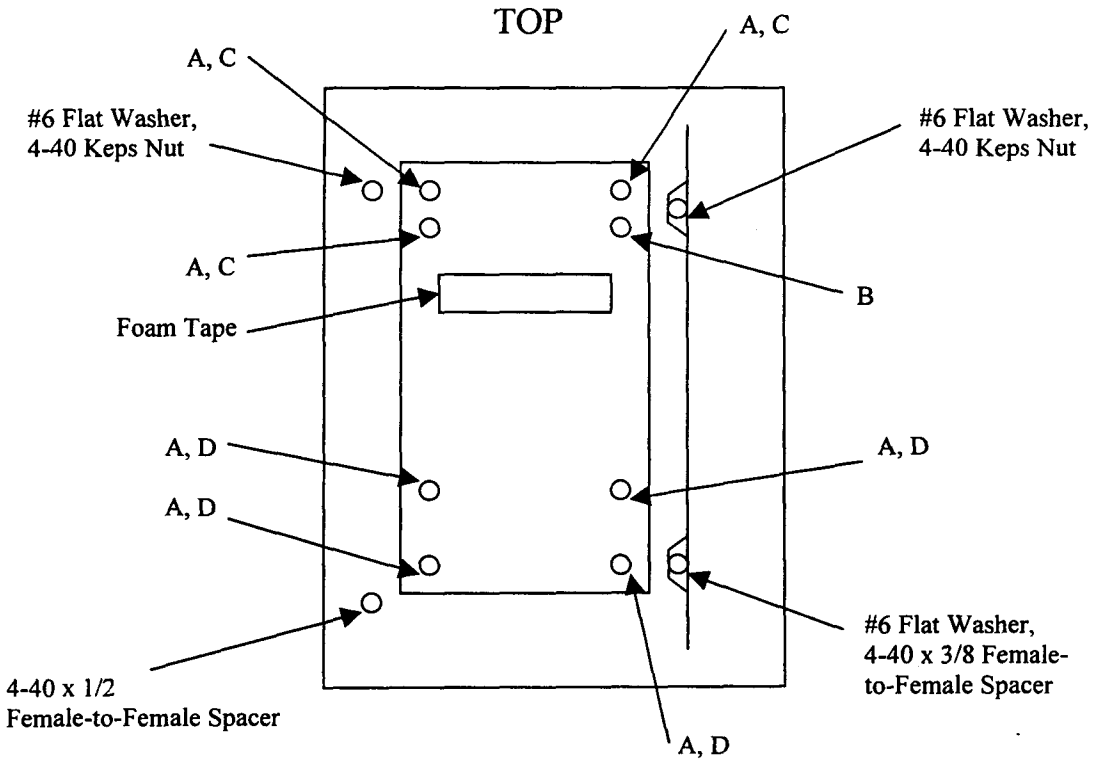
11. Remove Switch Guard (133-0001-00) and two lockwashers securing Manual Trigger Pushbutton Switch to Front Panel (422-0754-11).

12. Remove three 4-40 Keps Nuts (346-0440-01) and four 4-40 x 3/8 Male-to-Female Spacers (368-0029-00) mounting Display/Switch Panel PCB (702-0754-01) to Front Panel (422-0754-11).

NOTE: The following diagrams provide additional Top Cover/Front Panel hardware location information.

To reassemble, reverse the above steps.

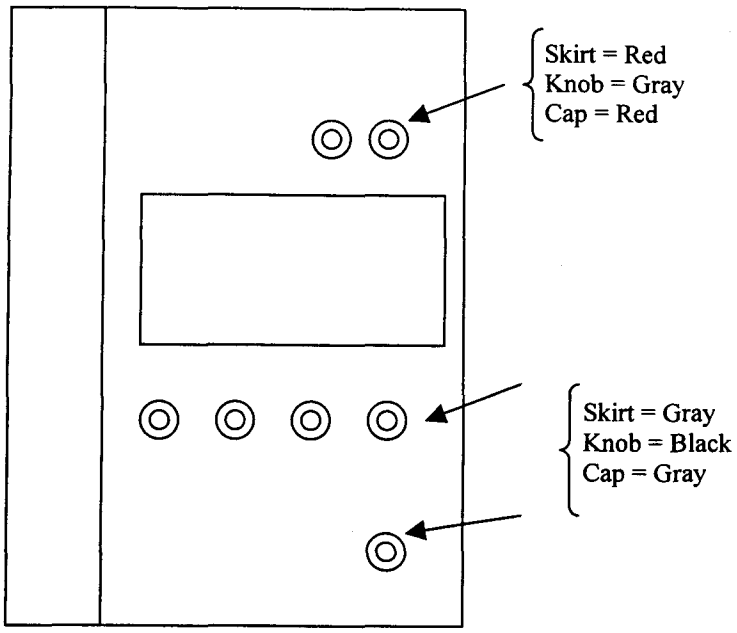
NOTE: When mounting Display/Switch Panel PCB (702-0754-01) to Front Panel (422-0754-11) verify that controls align properly. Pushbutton switches must have "free travel" and not stick to inside walls of Front Panel when depressed.



A = 4-40 X 1/2 Male-to-Female Spacer
B = 4-40 X 1/2 Female-to-Female Spacer
C = 4-40 Keps Nut
D = 4-40 X 3/8 Male-to-Female Spacer

UPPER CASE ASSEMBLY - INSIDE VIEW - HARDWARE LOCATIONS

UPPER CASE ASSEMBLY
OUTSIDE VIEW
SKIRT, KNOB & CAP
LOCATIONS



LOWER CASE ASSEMBLY

The Lower Case Assembly (703-0754-05) consists of the following essential elements: Flow Manifold and Ribbon Cable, Exhaust Manifold, Filter PCB, Compressor Air Inlet, Compressor and Autocal Valve.

To disassemble, place Lower Case Assembly on Foam Pad.

Remove four Cable Ties (305-0001-00) securing 3/8" ID PVC hoses to hose barbs. One cable tie connects to each hose barb on the Flow Manifold (703-0754-01), two total; and one connects to each upper hose barb on the Compressor Assembly (704-0754-05), two total.

Remove Filter (465-0012-00) from 22mm Compressor Air Inlet Fitting (420-0754-11).

Disconnect the following hoses, as indicated. The small hemostat may be helpful in performing these operations.

a. One end of 4" long PVC hose (540-0141-00) with 3 1/4" Spring (370-0009-00) where it connects to the right hose barb on Flow Manifold (703-0754-01).

b. One end of 1/8" ID x 8 1/2" hose (540-0144-00) from Exhaust Manifold (703-0754-04) "Tee" where it connects to the AUTOCAL Solenoid brass hose barb (480-0192-00).

c. One end of 1/8" ID x 8 3/4" hose (540-0150-00) from Exhaust Manifold (703-0754-04) where it connects to the red hose barb (480-0227-00) on Flow Manifold (703-0754-01).

d. One end of 1/8" ID x 3 1/2" hose (540-0136-00) from Exhaust Manifold (703-0754-04) where it connects to the Exhalation Bulkhead fitting hose barb (480-0239-00).

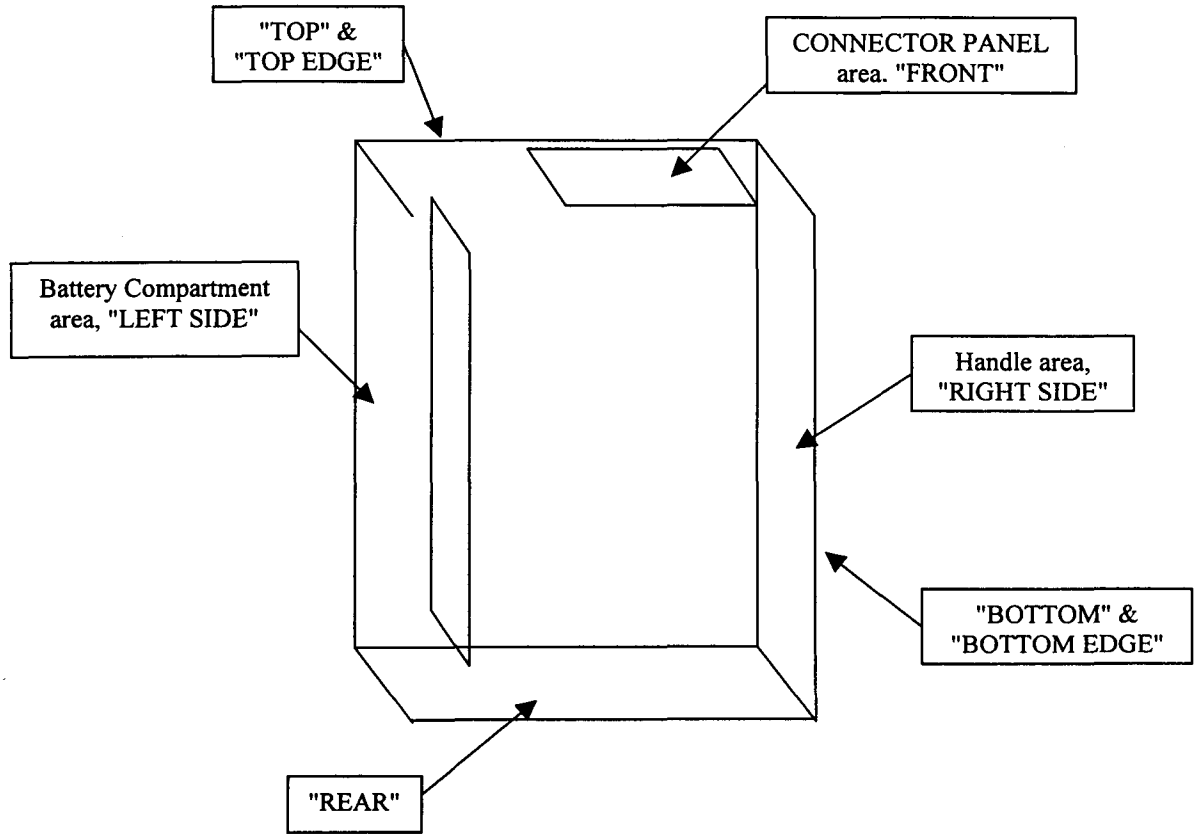
e. One end of 1/8" ID x 2 1/4" hose (540-0146-00) from Exhaust Manifold (703-0754-04) "Tee" where it connects to black hose barb (480-0235-00) located on front, right side of Lower Case (416-0754-11).

f. One end of 1/8" ID x 8 1/2" hose (540-0144-00) from AUTOCAL Solenoid nickel-plated hose barb (480-0194-00) where it connects to the Transducer Bulkhead fitting hose barb (480-0238-00).

g. One end of 4 1/2" long PVC hose (540-0142-00) from Compressor Assembly (704-0754-05) where it connects to the left hose barb on top of the Flow Manifold Assembly (703-0754-01).

h. One end of 5" long PVC hose (540-0020-00) from Compressor Air Inlet Assembly (704-0754-04) where it connects to the top left hose barb of Compressor Assembly (704-0754-05).

NOTE: The following diagram provides Bottom Cover reference information.



LOWER CASE ASSEMBLY VIEW REFERENCES (assembly references for the Lower Case will always be made from "rear" looking towards the "front")

DISASSEMBLY OF THE COMPRESSOR, AUTOCAL VALVE, AND EXHAUST MANIFOLD FROM LOWER CASE

Remove the Compressor Assembly (704-0754-05) (includes Autocal Valve Assembly, 704-0754-07), and the Exhaust Manifold Assembly (703-0754-03) as follows:

a. Stand Lower Case Assembly (703-0754-05) upright on Foam Pad. Locate 6-32 x 1/2 Phillips Pan Head Screw (358-0632-08) adjacent to Condensed Operating Instructions Label (325-0754-01). This screw passes through underside of Lower Case (416-0754-11) and stainless steel bracket attached to the Compressor Assembly (704-0754-05) and is secured with a #6 Flat Washer (376-0007-00) and 6-32 Keps Nut (346-0632-01). Remove the screw, washer and keps nut.

b. Remove two 6-32 x 1/2 Phillips Pan Head Screws (358-0632-08) that pass through the Condensed Operating Instructions Label (325-0754-01), Lower Case (416-0754-11), Exhaust Manifold Chassis (414-0754-11), and thread into the Compressor Assembly (704-0754-05). Carefully remove Compressor Assembly (704-0754-05) from Lower Case (416-0754-11) using upward-angled force to unseat its "long" hose barb from the Compressor Air Inlet Assembly (704-0754-04) bushing (340-0019-00).

c. Lift Exhaust Manifold Assembly (703-0754-04) from Lower Case (416-0754-11).

REMOVAL OF BULKHEAD FITTINGS

Remove Exhalation Bulkhead fitting (480-0239-00) (clear) with a 3/8" Deep Socket and 7/16" Open End Wrench.
It attaches through the Connector Panel and Connector Sub-Panel with a 1/4" Solder Lug and 1/4-20 Nut (346-1420-00).

Remove Transducer Bulkhead fitting (480-0238-00) (green) with a 3/8" Deep Socket and 7/16" Open End Wrench. It attaches through the Connector Panel and Connector Sub-Panel with a 1/4-20 Nut (346-1420-00).

DISASSEMBLY OF THE FLOW MANIFOLD FROM LOWER CASE

Remove Flow Manifold Assembly (703-0754-01) from Lower Case (416-0754-11) as follows:

a. Unscrew top left innermost 4-40 Phillips Pan Head Screw from Flow Manifold (703-0754-01) to disconnect 9" Braid (011-0002-00) with #4 Solder Lug (344-0002-00) from Filter PCB Assembly (704-0754-03).

b. Unscrew 3/4-16 Nut (346-3416-00) from air fitting protruding through Connector Panel cutout using 1" Socket.

c. Unscrew 9/16-18 Nut (346-9618-02) from oxygen fitting protruding through Connector Panel using 13/16" Socket.

d. Unscrew 22mm Gas Outlet Adapter (480-0223-00) with O-ring (340-0061-00) from Flow Manifold (703-0754-01) using 1" Socket.

e. Remove screen (804-0006-00) from Flow Manifold (703-0754-01).

f. Slide Connector Panel (422-0754-21) from Flow Manifold (703-0754-01) air and oxygen fittings protruding through Connector Panel cutout.

g. Carefully remove Flow Manifold (703-0754-01) with Connector Sub-Panel (422-0754-41) from Lower Case (416-0754-11).

h. Remove Connector Sub-Panel (422-0754-41) from Flow Manifold (703-0754-01).

DISASSEMBLY OF THE COMPRESSOR AIR INLET FROM LOWER CASE

Remove Compressor Air Inlet Assembly (704-0754-04) from Lower Case (416-0754-11) by removing three 4-40 x 1/2 Phillips Pan Head Screws (358-0440-08). These screws secure 22mm Compressor Air Inlet Fitting (420-0754-11) through Lower Case (416-0754-11) side wall.

> *NOTE: The Filter PCB Assembly is mechanically assembled to the Lower Case (416-0754-11) and hard wired to various connectors and fuseholders. If disassembly is required, it will include mechanical disassembly and desoldering of components. The degree of disassembly required will be determined by the operation performed. Under most circumstances, this level of disassembly will not be required.*

To reassemble the major Lower Case Assemblies, reverse the above steps.

DISASSEMBLY OF THE FLOW MANIFOLD

The Flow Manifold can only be partially disassembled. Unless its transducers are damaged, usually caused by excessive pressure, damage to the Flow Manifold is generally limited to its valves becoming clogged with "dirt" from an unclean compressed gas source. The entire Flow Manifold should be carefully handled in a clean, oil-free environment. Replacement of the entire Manifold is necessary except when repair is limited to replacement of the Variable Orifice Solenoids (490-0056-00). The following instructions pertain only to this level of repair.

From the Variable Orifice Solenoid (490-0056-00) to be replaced, carefully unsolder wires from its coil.

Unscrew the 4-40 x 11/16 screws securing valve to Flow Manifold. DO NOT lose O-rings that seal valve to manifold.

To reassemble, reverse the above steps.

DISASSEMBLY OF THE EXHAUST MANIFOLD

1. Remove the following tubing:

   a. 3 1/2" tubing (540-0136-00) from white Elbow (480-0228-00).

   b. 8 3/4"tubing (540-0150-00) to Red Hose Barb (480-0227-00).

   c. 2 1/4" tubing (540-0146-00) to center leg of Tee fitting #2 (480-0230-00).

   d. 1" tubing (540-0138-00) between Tee fitting #2 (480-0230-00) and Elbow (480-0229-00).

   e. 8 1/2" tubing (540-0144-00) to Tee #1 (480-0230-00).

   f. 3/4" tubing (540-0032-00), two pieces, to Tee fittings #1 and #2 (480-0230-00), and Branch Tee (480-0231-00).

2. Slightly rotate Branch Tee (480-0231-00) and Elbow (480-0232-00) to facilitate removal of Restrictor (478-0003-00) and 1/2" tubing (540-0139-00). Note direction of Restrictor arrow for reassembly.

3. Unscrew Branch Tee (480-0231-00) from exhaust port of Solenoid Valve "A". "A" is the Solenoid closest to the White and Black Elbows (480-0228-00 and 480-0229-00).

4. Unscrew Black Elbow (480-0232-00) from exhaust port of Solenoid Valve "C". "C" is the Solenoid furthest from "A".

5. Unsolder ribbon cable wires and jumpers as necessary from Solenoid coils. Note location of wires and jumpers before unsoldering.

6. Each Solenoid is secured to the Manifold (470-0754-51) by two hex socket cap screws. A gasket is "sandwiched" between the Solenoid and Manifold (470-0754-51). When removing a Solenoid, note the position of its solder tabs.

7. Unscrew four 4-40 x 1/2 Phillips Flat Head Screws (357-0440-08) and four #8 x 1/4" Nylon Spacers (368-0004-00) to separate Exhaust Manifold (470-0754-51) from Solenoid Chassis (414-0754-11).

   NOTE: Before unscrewing the following parts, note their orientation.

8. Unscrew Red Hose Barb (480-0227-00) from Manifold (470-0754-51).

9. Unscrew Black Swivel Elbow (K) from Manifold (470-0754-51).

10. Unscrew White Elbow (480-0228-00) from Manifold (470-0754-51).

To reassemble, reverse the above steps.

DISASSEMBLY OF THE COMPRESSOR AIR INLET

Limited disassembly of the Compressor Air Inlet is permissible, as follows:

1. Remove Hose (540-0020-00) with Spring (370-0008-00) from Hose Barb (480-0226-00).

2. Remove Bushing (340-0019-00) from Pump Inlet Adapter (480-0234-00).

To reassemble, reverse the above steps.

DISASSEMBLY OF THE COMPRESSOR

Limited disassembly of the Compressor is permissible, as follows:

1. Unscrew two Phillips Flat Head Screws (357-0632-05) that secure Autocal Valve Assembly (704-0754-07) to Compressor (041-0021-00).

2. Remove Cable Tie (305-0001-00) securing Hose (540-0142-00) with Spring (370-0010-00) to lower right Hose Barb (480-0226-00).

   NOTE: Reference to "lower right" is when looking at Compressor/Motor.

3. Remove lower right Hose Barb (480-0226-00) from Compressor.

To reassemble, reverse the above steps.

DISASSEMBLY OF THE AUTOCAL VALVE

Limited disassembly of the Autocal Valve is permissible, as follows:

1. Unscrew two M2 x 0.4 x 16mm Phillips Head Screws securing Solenoid (033-0013-00) to Manifold (470-0754-61).

2. Remove Gasket (340-0077-00) between Solenoid (033-0013-00) and Manifold (470-0754-61).

3. Unscrew 4-40 x 5/16 Phillips Flat Head Screws (357-0440-05) securing Mounting Bracket (404-0754-41) from Manifold (470-0754-61).

4. Remove Hose Barbs (480-0192-00, 480-0194-00, and 480-0227-00) from Manifold (470-0754-61). Note their material, color and location. Remove Neoprene Gaskets (340-0062-00) used between the Brass and Nickel-Plated barbs and Manifold (470-0754-61).

To reassemble, reverse the above steps.

DISASSEMBLY OF THE UNIVERSAL AC-DC POWER SUPPLIES

Universal AC-DC Power Supplies <u>are not</u> field serviceable. The Standard Power Supply contains a switching power supply module. The Optional Power Supply contains a switching power supply module and a DC-DC Converter module. Power Supplies must be replaced when a module becomes defective.

Cables, connectors and plugs integrate with these modules. The risk of damage to modules, caused by servicing cables, connectors, or plugs is very high. <u>DO NOT</u> attempt to service these assemblies.

DISASSEMBLY OF THE PATIENT VALVE (OPTIONAL ACCESSORY)

The Patient Valve Assembly allows limited disassembly as follows:

1. Unscrew Collar (490-0023-00) to release assembled Exhalation Cap (490-0058-00) from Valve Housing (490-0020-00). Note "key" in Exhalation Cap that aligns with "slot" in Valve Housing.

2. Detach Inlet Elbow (490-0025-00) from Valve Housing (490-0020-00).

3. Unscrew Diaphragm Valve (490-0059-00) from Exhalation Cap (490-0058-00).

4. Remove Leaf Valve (490-0005-00) from Valve Housing (490-0020-00).

To reassemble, reverse the above steps.

NOTE: When reattaching Leaf Valve (490-0005-00) to Valve Housing (490-0020-00), make sure it properly seats and locks into place.

CALIBRATION PROCEDURE

COMPUTER CALIBRATION

1.0 INITIAL SETUP

1.1 MATERIALS/EQUIPMENT REQUIRED
- 1.1.1 RT-200 Calibration Analyzer
- 1.1.2 Computer with calibration software (diskette provided)
- 1.1.3 Cable, 9-Pin RS232 male x 9-Pin RS232 female
- 1.1.4 Cable,25-Pin RS232 male x 25-Pin RS232 female
- 1.1.5 AC Power Supply
- 1.1.6 Oxygen Hose, D.I.S.S. X D.I.S.S.
- 1.1.7 Air Hose, D.I.S.S. X D.I.S.S.
- 1.1.8 Accumulator, 22mm male x 22mm male
- 1.1.9 Tubing, 22mm, 6 foot length
- 1.1.10 Tubing, 22mm, 2 foot length
- 1.1.11 Tubing, 1/8 ID, 2 foot length, 3 pieces
- 1.1.12 Tee, 1/8 hosebarb
- 1.1.13 Pushbutton Assembly with 2-pin connector
- 1.1.14 Syringe, 6 cc

1.2 CONNECTIONS
- 1.2.1 Connect oxygen and air to their respective fittings and pressurize to 50 PSI.
- 1.2.2 Connect 22 mm hose (6 foot) from outlet fitting to RT-200. The exhalation valve control is disabled during computer calibration, therefore, do not use disposable patient valve circuit.
- 1.2.3 Connect AC Power Supply between External Power Jack and external power source.
- 1.2.4 Connect 9-Pin RS232 wire harness to computer and to AC Power supply.
- 1.2.5 Connect 25 Pin RS232 cable to RT-200 and to computer.
- 1.2.6 Connect Pushbutton Assembly to 2-pin jumper on CPU board via notch in battery compartment divider (behind copper tape).

1.3 POWER UP
- 1.3.1 Turn on RT-200
- 1.3.2 Turn on ventilator. NOTE: Unit cannot be calibrated during a system failure alarm.
- 1.3.3 Turn on computer. Go into calibration program by typing CAL, and then hit any key. Setup messages will flash by in the lower left hand corner. The messages are:
  - 1.3.3.1 Please Wait While Reset Com Ports.
  - 1.3.3.2 Please Wait While Reset Rt-200.
  - 1.3.3.3 Please Wait While Reset Vent754.

1.4 ERROR MESSAGES
- 1.4.1 If there are any connection problems, an error message will flash in red in the lower left hand corner. It will read "Vent754 COMMUNICATION SETUP ERROR!!".
- 1.4.2 If the RT-200 is not connected properly or not turned on, the setup messages will move very slowly. There will be no error message.
- 1.4.3 If an error message is given, or the RT-200 is not properly connected, exit the program by pressing F10. Fix the problem, and reenter the program.
- 1.4.4 If there are any problems during calibration, error messages will be in the Current Calibration Status field and will be in red.

2.0 CALIBRATION PROGRAM

Note: During the calibration program, there are six main fields shown on the computer. They are:

Current Calibration Program (CC Program)
Current Calibration Point (CC Point)
Current Calibration Status (CC Status)
Current RT-200 Function (RT-200 Function)
Current RT-200 Data (RT-200 Data)
Last Data Sent to Vent754 (Last Data).

Note: KEY DESCRIPTIONS

Table of keystrokes functions in calibration program:

KEY	DESCRIPTION
F1	Selects Programs
F2	Selects Points
F3	Initializes EEPROM; Resets Real Time Clock
F4	Saves Data to EPROM
F5	Hold/Releases Unit
F6	Initializes Program
F7	Clears Protection Flag
F8	Loads Default Values
F10	Exits Calibration Program
<RET>	Begins Calibration of Specific Point
1	Enables EEPROM Protection Programming (Program Mode)
2	Clears Protection (PUSHBUTTON SWITCH PRESSED)
3	Sets Protection (PUSHBUTTON SWITCH PRESSED)
4	Exits EEPROM Protection Programming (Program Mode)
5	View Protection Status (PUSHBUTTON SWITCH PRESSED) Protected: "EEPROM Protection Address is correct" Unprotected: "Incorrect Protection Address at 255".

2.1 HOLD

2.1.1 Press F5 on the computer to "Hold" the ventilator to be calibrated.

2.1.1.1 In the lower left hand corner on the computer screen, the Hold should toggle from OFF to ON.

2.1.1.2 The unit should stop operating. The LCD screen of the 754 ventilator should read "FACTORY CALIBRATION".

2.1.1.3 CC Program: Factory Calibration

2.1.1.4 CC Point: Blank

2.1.1.5 CC Status: Blank

2.1.1.6 RT-200 Function: Blank

2.1.1.7 RT-200 Data: Blank

2.1.1.8 Last Data: Blank

2.2 OXYGEN & MIXED FLOW SENSORS

Note: During this portion of the calibration, the Mixed Flow sensor is calibrated along with the Oxygen Sensor.

2.2.1 Press F1 to enter first program.

2.2.1.1 CC Program: Calibrate O2 & Mix Flow

2.2.1.1.1 Description: This Program is to Calibrate O2 & Mix Flow Sensors Together. It Will Calibrate 0-6, 7 points.

2.2.1.1.2 The CC Program will not change until the F1 key is pressed again.

2.2.1.2 CC Point: Blank
2.2.1.3 CC Status: Blank.
2.2.1.4 RT-200 Function: #35, Measure Flow...
2.2.1.4.1 The Function field will not change until the F1 key is pressed again.
2.2.1.5 RT-200 Data: 0.0 of 180 LPM O2%/N2
2.2.1.6 Last Data: Blank

2.2.2 Press F2 to call up first calibration point.
2.2.2.1 CC Point: 0
2.2.2.1.1 Description: Targeting Flow for 0.0 LPM.
2.2.2.2 CC Status: Blank.
2.2.2.3 RT-200 Data: 0.0 of 180 LPM
2.2.2.4 Last Data: Blank

2.2.3 Press <Ret> to start calibrating first point. No gas will flow because 0.0 LPM is the first calibration point. The calibration point will automatically lock in and the fields will read:
2.2.3.1 CC Point: 0
2.2.1.2.1 Description: Targeting Flow for 0.0 LPM.
2.2.3.2 CC Status: Calibration For Current Point OK!
2.2.3.3 RT-200 Data: 0.0 of 180 LPM
2.2.3.4 Last Data: Blank

2.2.4 Press F2 to call up next calibration point. The CC Status will blank. Hit the <Ret> key. Gas will begin to flow. The flow rate will vary in the RT-200 Data field and adjust until it reaches a rate of 10.0 LPM (+/- 0.5 LPM). The calibration point will lock in and the fields should read:
2.2.4.1 CC Point: 1
2.2.4.1.1 Description: Targeting Flow for 10.0 LPM.
2.2.4.2 CC Status: Calibration For Current Point OK!
2.2.4.3 RT-200 Data: 0.0 of 180 LPM
2.2.4.4 Last Data: ##.# of 180 LPM O2%/N2.
2.2.4.4.1 ##.# is a value that should be 10.0 LPM (+/- 0.5 LPM).

2.2.5 Continue to Press F2 and call up next calibration point and press the <Ret> key to start the calibration. Calibration is done for oxygen flows of 0-60 LPM in increments of 10 LPM. During each increment, the CC Point, CC Status, RT-200 Data, and Last Data fields will vary. After the oxygen flow for 60 LPM is calibrated, do <u>not</u> press F2. The calibration for O2 & Mixed Flow is complete.

2.3 EXTERNAL AIR SENSOR

2.3.1 Press F1 to enter the next program. The fields will show the following:
2.3.1.1 CC Program: Calibrate External Air Flow
2.3.1.1.1 Description: This Program is to Calibrate External Air Flow Sensor. It Will Calibrate 0-6, 7 points.
2.3.1.1.2 The CC Program will not change until the F1 key is pressed again.
2.3.1.2 CC Point: Blank
2.3.1.3 CC Status: Previous Calibration Program is OK!

Note: If an error occurred in the previous program, An error message "Previous Program Fail!" will appear in red in the CC Status field at this time.

2.3.1.4 RT-200 Function: #36, Measure Flow...
2.3.1.4.1 The Function field will not change until the F1 key is pressed again.
2.3.1.5 RT-200 Data: 0.0 of 180 LPM O2%/N2
2.3.1.6 Last Data: ##.# of 180 lpm O2%/N2
2.3.1.6.1 ##.# is a value that should be 60.0 LPM (+/- 0.5 LPM).

2.3.2 Go through the 7 points on the External Air Sensor Program the same way as the O2 & Mixed Flow Sensor Program. There should be only three differences.
2.3.2.1 The CC Program is the External Air Program, not the O2 & Mixed Flow.
2.3.2.2 The RT-200 Function now reads #36 (Air Flow) instead of reading #35 (Oxygen Flow).
2.3.2.3 The gas source should now be external air.
2.3.3 After the external air flow for 60 LPM is calibrated, do not press F2. The calibration for External Air Flow is complete.

2.4 COMPRESSOR SPEED
2.4.1 Press F1 to enter the next program. The fields will show the following:
2.4.1.1 CC Program: Calibrate Compressor Speed
2.4.1.1.1 Description: This Program is to Calibrate Internal Compressor Speed. It'll Normally Calibrate 1-6, 6 points.
2.4.1.1.2 The CC Program will not change until the F1 key is pressed again.
2.4.1.2 CC Point: Blank
2.4.1.3 CC Status: Previous Calibration Program is OK!
Note: If an error occurred in the previous program, An error message "Previous Program Fail!" will appear in red in the CC Status field at this time.
2.4.1.4 RT-200 Function: #36, Measure Flow...
2.4.1.4.1 The Function field will not change until the F1 key is pressed again.
2.4.1.5 RT-200 Data: 0.0 of 180 LPM O2%/N2
2.4.1.6 Last Data: ##.# of 180 lpm O2%/N2
2.4.1.6.1 ##.# is a value that should be 60.0 LPM (+/- 0.5 LPM).
2.4.2 Install Accumulator between RT-200 and ventilator using 22mm tubing (2 feet and 6 feet pieces).
2.4.3 Go through the 6 points on the Compressor Speed Program the same way as the O2 & Mixed Flow Sensor Program. There should be only four differences.
2.4.3.1 The CC Program is the Compressor Speed Program, not the O2 & Mixed Flow.
2.4.3.2 The RT-200 Function now reads #36 (Air Flow) instead of reading #35 (Oxygen Flow).
2.4.3.3 The gas source should now be from the internal compressor.
2.4.3.4 The first calibration point is 10 LPM. There is no calibrating zero flow in the compressor speed program.
2.4.4 After the compressor speed for 60 LPM is calibrated, do not press F2. The calibration for Compressor Speed is complete.

2.5 AIRWAY PRESSURE
2.5.1 Press F1 to enter the next program. The fields will show the following:
2.5.1.1 CC Program: Calibrate Pressure
2.5.1.1.1 Description: This Program is to Calibrate Internal Airway Pressure Sensor. It'll Calibrate at 0 and 100 cmH2O.
2.5.1.1.2 The CC Program will not change until the F1 key is pressed again.
2.5.1.2 CC Point: Blank
2.5.1.3 CC Status: Previous Calibration Program is OK!
Note: If an error occurred in the previous program, An error message "Previous Program Fail!" will appear in red in the CC Status field at this time.
2.5.1.4 RT-200 Function: #12, Measure Pressure...
2.5.1.4.1 The Function field will not change until the F1 key is pressed again.
2.5.1.5 RT-200 Data: 0.0 of 250 cmH2O
2.5.1.6 Last Data: ##.# of 180 lpm O2%/N2
2.4.1.6.1 ##.# is a value that should be 60.0 LPM (+/- 0.5 LPM).

2.5.2 Press F2 to call up the first calibration point.
- 2.5.2.1 CC Point: 0
  - 2.5.2.1.1 Description: Target Pressure at 0 cmH2O
- 2.5.2.2 CC Status: Blank.
- 2.5.2.3 RT-200 Data: 0.0 of 250 cmH2O
- 2.5.2.4 Last Data: ##.# of 180 lpm O2%/N2
  - 2.5.2.4.1 ##.# is a value that should be 60.0 LPM (+/- 0.5 LPM).

2.5.3 Press <Ret> to start calibrating first point. Because 0.0 cmH2O is the first calibration point, the calibration point will automatically lock in at 0.0 cmH20. The fields will read:
- 2.5.3.1 CC Point: 0
  - 2.2.1.2.1 Description: Targeting Flow for 0.0 LPM.
- 2.5.3.2 CC Status: Calibration For Current Point OK!
- 2.5.3.3 RT-200 Data: 0.0 of 250 cmH20
- 2.5.3.4 Last Data: ##.# of 180 lpm O2%/N2
  - 2.4.1.6.1 ##.# is a value that should be 60.0 LPM (+/- 0.5 LPM).

2.5.4 Verify Pushbutton Assembly with 2-pin connector is attached to the 2-pin jumper on the CPU pcb. Access to the pins is achieved via the notch in battery compartment divider. While the Pushbutton assembly is not used in section 2.5.5, it is better to verify it is connected now to avoid having the alarm generated in 2.5.7 sound off longer than necessary.

2.5.5 Press F2 to call up the next calibration point.
- 2.5.5.1 CC Point: 1
  - 2.5.5.1.1 Description: Target Pressure at 100 cmH2O
- 2.5.5.2 CC Status: Blank.
- 2.5.5.3 RT-200 Data: 0.0 of 250 cmH2O
- 2.5.5.4 Last Data: ##.# of 180 lpm O2%/N2
  - 2.5.5.4.1 ##.# is a value that should be 60.0 LPM (+/- 0.5 LPM).

2.5.6 Using 1/8 I.D. tubing, and 1/8 I.D. tee, connect RT-200 (P+ on low pressure range) to green transducer fitting on 754 ventilator and to 6 cc syringe.

2.5.7 Press <Ret> to start calibrating point. Slowly increase airway pressure to 100 cmH2O by pushing in on syringe. The RT-200 Data field will varying according to airway pressure. When the pressure has been above 40 cmH2O for 4 seconds, the ventilator will give a continuous alarm. This is acceptable, ignore it. When the airway pressure has reached a stable 100 cmH2O (+/- 0.5 cmH2O), the calibration point will lock in. The fields will read:
- 2.5.7.1 CC Point: 1
  - 2.5.7.1.1 Description: Targeting Pressure at 100.0 LPM.
- 2.5.7.2 CC Status: Calibration For Current Point OK!
- 2.5.7.3 RT-200 Data: ##.# of 250 cmH20
  - 2.4.1.6.1 ##.# is a value that should be 100.0 cmH2O (+/- 0.5 cmH2O).
- 2.2.3.4 Last Data: ##.# of 180 lpm O2%/N2
  - 2.4.1.6.1 ##.# is a value that should be 60.0 LPM (+/- 0.5 LPM).

2.5.8 Remove syringe from hose. Do not remove syringe by pulling back on syringe plunger. This could cause a high negative pressure that might damage transducer. Remove syringe by taking tubing off of syringe.

2.6 EEPROM

2.6.1 Press F1 to return to beginning of calibration program. The fields will show the following:
- 2.6.1.1 CC Program: Program Factory Calibration
- 2.6.1.2 CC Point: Blank
- 2.6.1.3 CC Status: Previous Calibration Program is OK!

Note: If an error occurred in the previous program, An error message "Previous Program Fail!" will appear in red in the CC Status field at this time.

2.6.1.4 RT-200 Function: Blank
2.6.1.5 RT-200 Data: Blank
2.6.1.6 Last Data: Blank

2.6.2 Unprotect EEPROM

2.6.2.1 Press the "1" key on the computer. The lower left hand corner should give the following message "EEPROM Program Mode Enabled"

2.6.2.2 Push and hold the pushbutton on the Pushbutton Assembly. Press the "2" key on the computer. The lower left hand corner should give the following message "EEPROM Protection Register is Cleared".

2.6.2.3 Continue holding the pushbutton on the Pushbutton Assembly, press the "5" key on the computer. The lower left hand corner should give the following message "Incorrect Protection Address is at 255".

2.6.2.4 Release the pushbutton and press the "4" key on the computer. The lower left hand corner should give the following message "EEPROM Program Mode Disabled.

2.6.3 Save Calibration Data to EEPROM

2.6.3.1 Press F4 on the computer. The lower left hand corner should give the following message "Saved Factory Calibration Data in EEPROM.

2.6.4 Protect EEPROM

2.6.4.1 Press the "1" key on the computer. The lower left hand corner should give the following message "EEPROM Program Mode Enabled"

2.6.4.2 Push and hold the pushbutton on the Pushbutton Assembly. Press the "3" key on the computer. The lower left hand corner should give the following message "EEPROM Protection Register is Set".

2.6.4.3 Continue holding the pushbutton on the Pushbutton Assembly, press the "5" key on the computer. The lower left hand corner should give the following message "EEPROM Protection Address Is Correct".

2.6.4.4 Release the pushbutton and press the "4" key on the computer. The lower left hand corner should give the following message "EEPROM Program Mode Disabled.

2.6.5 Initialize EEPROM / Reset Real Time Clock

2.6.5.1 Press F3 on the computer to Initilaize EEPROM and reset the Real Time Clock.

2.7 Release Ventilator and Exit program.

2.7.1 Press F5 on the computer. The ventilator is "released".

2.7.1.1 In the lower left hand corner on the computer screen, the Hold should toggle from ON to OFF.

2.7.1.2 The unit should reboot. If the real time clock was reset, the unit will need to be put into CAL mode and allowed to recal.

2.7.2 Press F10 on the computer. This will exit the calibration program.

3.0 SAVING DATA

3.1 Data from Calibration Program is initially saved in the file called FCALDATA.TXT.

3.2 Rename the file as follows: S/N of unit (ex. 9706005) with alphabetic revision (nothing for the initial file, "A" is the first revision). Use the suffix ".TXT".

3.2.1 The file name for the example S/N would be 9706005.TXT.

3.2.2 The first revision would be 9706005A.TXT

4.0 INITIALIZING EEPROM / RESETING THE REAL TIME CLOCK

Note: To Initialize EEPROM and reset the real time clock, not all of the connections from section 1.2 are needed.

4.1 CONNECTIONS

4.1.1 Connect AC power supply between External power jack and external power source.

4.1.2 Connect 9-Pin RS232 wire harness to computer and to AC Power Supply.

4.2 POWER UP

4.2.1 Turn on ventilator. NOTE: Unit cannot be calibrated during a system failure alarm.

4.2.2 Turn on computer. Go into calibration program by typing CAL, and then hit any key. Setup messages will flash by in the lower left hand corner. If the RT-200 is not connected, the setup messages will flash by slowly. Wait until the messages have flashed by (about 10 seconds).

4.3 HOLD - Press F5 to "Hold" the ventilator.

4.4 INITIALIZE EEPROM /RESET REAL TIME CLOCK - Press F3 to Initialize EEPROM and reset the Real Time Clock.

4.5 EXITING PROGRAM

4.5.1 Press F5 to "Release" the ventilator.

4.5.2 Press F10 to exit the calibration program.

4.5.3 The unit should reboot, and a Transducer Calibration alarm will occur. Put the unit in the CAL mode and recal the ventilator.

4.5.4 No data from a Real Time Clock reset needs to be saved.

CIRCUIT DESCRIPTIONS

(Refer to attached Schematic and Assembly drawings).

1. DISPLAY/SWITCH PANEL PCB (702-0754-01)

The Display/Switch Panel PCB contains the following circuitry:

a. MODE SWITCH

The Mode Switch (SW11) is a double pole, 5-position switch that connects signals to ground. Each signal has a pullup resistor on the CPU board to bring it to a logic level 1 when not selected by the Mode Switch.

b. CONTROL POTS

Each control pot provides a continuously variable signal between 0 and 5 Volts for setting its corresponding control.

c. KEY MATRIX

The Key Matrix is connected to a 74LS240 Line Driver/Line Receiver chip on the CPU board. The columns are driven by the chip (under CPU control), while the rows are read. Pullup resistors on the CPU board keep the rows pulled high unless a pushbutton is depressed.

d. INDICATORS

The main indicator is the LCD. It supplies text and graphics information and is controlled by the CPU. The CPU is plugged into CN3. Its signals come from the CPU board via CN1.

Other visual indicators are the Alarm LED (D2) controlled by the CPU, the Charge LED (D9) controlled by U5 on the Power PCB, and the System Fail LED (D1). The System Fail LED can be activated in two ways: from the CPU board via signal CPURUN (activated if microcontroller is not running), or from the power board via signal FAILURE (activated if VCC power supply is not valid and Mode Switch is turned to any position except OFF).

There is one audible indicator (SPKR1) which can be activated in two ways: from the CPU board via signal PIEZO (activated by the microcontroller), or from the power board via signal FAILURE (activated if VCC power supply is not valid and Mode Switch is turned to any position except OFF).

e. SENSORS

The temperature sensor Q1 gives an output proportional to temperature (LM34: approximately 10mv/°F).

The Light Sensor (PC1) changes resistance with light intensity, providing an output voltage in the range of 0 to 5 Volts as the light intensity goes from light to dark (i.e. as light decreases, resistance of photosensor goes up).

f. RS232 INTERFACE

U1 is an RS232 transmitter/receiver chip with onboard RS232 power supplies (+/- 10V). It takes in standard RS232 voltage levels and converts them to standard logic levels on its receiver channels, and takes standard logic level voltages on its transmit channels and converts them to standard RS232 levels.

2. CPU PCB (702-0754-03)

The CPU circuit board can be subdivided into the following sections of circuitry:

a. MICROCONTROLLER

The microcontroller (U1) is a Phillips 80C552-24 device. It is an 8-bit processor and has an onboard 8 channel A/D converter, RS232 port with internal baud rate generation, two pulse width modulators, and runs on a 20MHz crystal controlled clock.

b. EPLD

The EPLD (U6) is a Xylynx XC7354 Programmable Logic Device and contains all the glue logic for the CPU. It also contains the firmware that comprises the "Backup Ventilator". The 555 Timer (U13) serves as the clock for the Backup Ventilator.

c. MEMORY SUBSYTEM

The memory subsystem consists of U5 (EEPROM for non-volatile storage), U2 (ROM) and U3 (RAM), as well as U4 which multiplexes the Data Bus and the lower 8 bits of the Address Bus.

d. ANALOG INPUT SECTION

All analog inputs connect to the A/D Converter in the microcontroller (U1). Some are connected directly, while a number of slower changing signals are multiplexed via U11 and U12 (4051 Analog Switches). Also, the temperature sensor signal VLCDTEMP is amplified with U15 before it is sent to multiplexer U12. A +5V reference (U16) supplies both the A/D Converter (in U1) and the D to A Converter (U9: see below). The +5V reference also serves as the supply for the control pots on the Display/Switch Panel PCB.

e. ANALOG OUTPUT SECTION

U9 is the D to A Converter, and provides analog outputs in the range of 0 to +5 Volts under CPU control. Only 2 outputs are utilized:

VCOMPRESSOR controls compressor speed on the Motor Drive PCB.

VCONTRAST controls the contrast of the LCD (this voltage must be varied with temperature to maintain proper contrast. U14 converts the positive voltage being supplied by the D to A converter to a negative voltage near -15V).

f. DIGITAL INPUTS

U7 scans in the state of the keys in the key matrix on the Display/Switch Panel PCB.

Columns COL1-COL4 are driven by U7 under CPU control via the Address Bus, while the rows are read via the Data Bus.

Pullup resistors keep the rows pulled high unless a pushbutton is depressed on the Display/Switch Panel PCB.

U8 reads in the position selected with the Mode Switch on the Display/Switch Panel PCB, as well as the Manual Breath and Mute pushbuttons.

g. REAL TIME CLOCK

The Real Time Clock (U10) contains the maintenance clocks. It keeps track of elapsed time and hours of use since the unit has had its last periodic maintenance, as well as duration of non-use until unit is turned on. A lithium battery on the CPU board powers U10 whenever the instrument is turned off.

3. ANALOG PCB (702-0754-02)

a. DIFFERENTIAL AMPLIFIERS

The Analog PCB has 7 differential amplifiers that amplify the 5 transducer signals coming from the Flow Manifold and signals from the two pressure transducers located on the Analog PCB.

The 5 Flow Manifold signals are: 2 tank pressure signals and 3 flow signals that are actually differential pressure signals. Analog PCB signals are: airway pressure and barometric pressure.

Each amplifier has provision for both offset and gain adjustment. The outputs are adjusted to provide a range representing 0.5V (at low end) to 4.5V (at high end). These amplifier settings equate to tank pressures ranging from 0 to 60 PSI, gas flows from 0 to 60 LPM, patient airway pressure from 0 to 100 cm H_2O, and baro sensing from 0.32 atm to 1 atm (approximately 28,500ft. elevation to sea level).

b. SENSORS

Two pressure sensors are located on the Analog PCB: the patient circuit airway pressure sensor (0 to 2 PSI relative to ambient pressure), and the barometric pressure sensor (0 to 15 PSI absolute).

c. COMPARATORS

U5 has 4 comparators that monitor the validity of the Mix Flow signal, tank pressure signals, and the patient circuit airway pressure signal for the "Backup Ventilator".

d. POWER SUPPLY CIRCUITS

U6 and U8 are standard 3-terminal regulators. The output of U6 is a +10V Reference Voltage used as the supply for all pressure sensors except one, several circuits on the Analog PCB, the power supply for the D to A Converter on the CPU PCB, the temperature sensor, the +5V Reference on the CPU PCB, and the audible indicator circuit on the Display/Switch panel PCB.

U8 generates the NEGREF voltage (-2.0V) used in the offset adjusting circuit of the differential amplifiers. U4-3 together with R22-R25 serves as a Voltage to Current Converter. The output of this circuit is the constant current supply for XDCR6 (patient circuit pressure sensor). Its output is 1ma. U4-4 together with R27-R28 generates the POSREF voltage (+2.0V) used in the offset adjusting circuit of the differential amplifiers.

e. TIME DELAYED LATCH

The Time Delayed Latch is a redundant protection circuit that opens the ventilator's exhalation valve and activates the system failure alarm when the patient circuit pressure stays above 40cmH_20 for more than 4 seconds. Input to the circuit is the BUAWPRESSUREOK signal from U5, pin 13. Whenever the airway pressure goes above 40 cmH_2O, this signal switches low. The reset pin on the CD4017 counter (U10, pin 15) is active high. When the BUAWPRESSUREOK signal goes low, the counter comes out of reset (conversely, when the BUAWPRESSUREOK signal goes high, the counter goes back into reset if it has not timed out and

latched). Since Output 9 (U10, pin 11) starts out low, the counter's active low enable pin (U10, pin 13) is also low and counting can begin when the BUAWPRESSUREOK signal goes low. The 555 timer (U11) provides a 2.5Hz clock for the timer. After 4 seconds, the Output 9 signal (pin 11) will switch high if the BUAWPRESSUREOK signal has remained low. The counter is now stopped (since clock enable is tied to Output 9). Output 9 is inverted by gate U12-3, which disables gate U12-1, no longer allowing the BUAWPRESSUREOK signal to affect the circuit and thereby latching it in the current state. U12-4 acts as an inverter and buffer. It drives Q3 to open the exhalation valve, and Q1, Q2 to activate the system failure alarm (both audible and visual). The circuit remains in this state until power is turned off for several seconds to allow power supply capacitors to bleed off.

4. MOTOR DRIVE PCB (702-0754-05)

a. BDC MOTOR DRIVE

The Brushless DC Motor Drive circuit is built around the Motorola MC33035 Brushless DC Motor Drive IC (U5). The IC takes in an analog input voltage (range approximately 1.5V to 4.1V from zero speed to full speed) at pin 11 that is the speed setpoint for the motor. Hall effect sensors in the motor are fed in on pins 4, 5, and 6 which allow electronic commutation of the motor. The chip's outputs AT,BT, CT and AB, BB, CB (pins 2, 1, 24, 21, 20, and 19) drive transistors that properly sequence the windings of the Brushless DC Motor. The current sense inputs CS+ and CS- (pins 9, and 15) provide over current protection by allowing the controller IC to sense and limit motor current. The BRAKE input (pin 23) needs to be switched low for the motor to run. When switched high, it performs dynamic braking by turning on only the bottom drive transistors Q2, Q4, and Q6.

The MC33039 Closed Loop Brushless Motor Adapter provides local closed loop speed control when the ventilator is operating in backup mode. In the normal mode, closed loop control is effected by the CPU. The 4053 Analog Switch (U6) selects which signal is used for setting the motor's speed: VSPEED (from the CPU) or VBACKUP (generated locally on the Motor Drive PCB at voltage divider R27, R28). It also switches in the output of U4 when in backup mode. Signal CPURUN controls the switch: when the CPU is running properly, control comes from the CPU.

b. BOOST VOLTAGE SUPPLY

The Boost Voltage Supply generates a voltage of approximately 25V (VCC + System input voltage) to drive the gates of N-Channel MOSFETS Q1, Q3, Q5, and Q9. It acts as a charge pump by charging C13 above SWVMOTOR (system input voltage switched by Q9) through C14 and D12.

c. DRIVERS

U8 is an array of darlington transistors that drive the valves on the Flow and Exhaust Manifolds. Q7 drives the backup solenoid on the Exhaust Manifold. Q13 drives the Autocal solenoid, and is only active when the CPURUN signal is valid.

d. BATTERY CHARGER

The Battery Charger is built around an LM3578 Switching Regulator IC. It is configured as a basic boost regulator, and has a nominal unloaded output voltage of 14 Volts at the cathode of D7 (across C2). Q10 switches power to the battery charger, so that it only operates when valid external power is present.

5. POWER PCB (702-0754-04)

a. SWITCHING POWER SUPPLY

The Switching Power Supply is built around an LM2577 Step-Up Voltage Regulator IC. It is configured as a flyback regulator. The flyback transformer has three secondary windings: +5V, +18V and –18V. The output of the 5V winding is fed back to the regulator IC for closed loop control. The other two outputs are proportional to the 5V winding based on their turns-ratio. They are fed into linear regulators to produce well-regulated +15V (VCC) and -15V outputs.

b. POWER SELECTION CIRCUIT

The Power Selection Circuit senses if valid external power is connected (> 10V). If there is valid external power, comparator U7 (LM311) will switch its output low, thereby turning on relays K1 and K2. Relay K1 supplies the control electronics, while relay K2 supplies power to the compressor. Hysteresis in this circuit prevents relay chatter (via feedback resistor R51 which provides a small amount of positive feedback). On decreasing external input voltage, the circuit switches to battery at around 9.5V, while on increasing external input voltage the circuit switches to external power at around 11V.

c. LOW BATTERY SHUTDOWN CIRCUIT

The Low Battery Shutdown circuitry switches power to the Switching Power Supply. The main switch is Q2, which supplies power to the LM2577 Regulator (U2). Q2 does not supply system power, rather it only powers the control circuitry inside U2. When sufficient input voltage is present (either from external power or a battery), the Low Battery Shutdown circuitry allows the Switching Power Supply to be turned on and also keeps it turned on. The sequence of events is as follows: When the Mode Switch on the Display/Switch Panel PCB is moved from the Off position, it connects the POWERON signal to ground. While C4 is charging, it initially acts as a short circuit. At that moment, R4 and R5 form a voltage divider, placing the base of Q2 (2N3906: PNP) at half the input voltage (more than sufficient to turn on Q2). Turning on Q2 powers up U2 (Switching Regulator) and comparator U8 (LM311). It also supplies power to reference diode D18, which sets the threshold for low battery shutdown. D18 is connected to the non-inverting input of comparator U8. Voltage divider R18, R19 supplies a proportion of the actual input voltage to the inverting input of the comparator. As long as the output of the voltage divider stays above 2.5V (8.5V input to voltage divider), the open collector output of the comparator (pin 7) keeps the bottom end of R5 at ground potential. This keeps Q2 turned on. If, however, the input voltage is insufficient to keep the output of the comparator switched low, as soon as C4 charges up, the bottom end of R5 rises. The new voltage divider is now made of 3 resistors: R4, R5, and R6: since R6 is 100K, 98% of the input voltage is dropped across it. The voltage at the base of Q2 is too high to keep it turned on: Q2 turns off, turning off U2 and the Switching Power Supply. Even if the input voltage rises again, Q2 cannot turn on again because C4 is now charged. Power is turned off when the Mode Switch on the Display/Switch Panel PCB is moved to the Off position, connecting the POWEROFF signal to ground, and pulling the inverting input of the comparator low. This turns off the output of U8. The bottom end of R5 rises and the voltage divider R4, R5, and R6 brings up the base of Q2, turning off the transistor. The Switching Power Supply is now turned off.

d. BATTERY CHARGE MONITOR

The Battery Charge Monitor is built around the BQ2050 power gauge IC. The IC senses if charging is taking place by monitoring the voltage across resistors R43A, B, C, and D (at U5, pin 9). Approximately 1 or 2 minutes after charging begins, pin 1 of U5 turns on to power the charge LED. Q13 gates this signal so that the charge LED on the Display/Switch Panel PCB can only light when valid external power is present.

e. FUSE AND POWER SUPPLY MONITOR

The Fuse and Power Supply Monitor circuits monitor several voltage points, and activate appropriate alarms when there is a malfunction in the power circuitry. Any time the Mode Switch is moved from the OFF position, Q6 (2N3906: PNP) is turned on since the POWERON signal is connected to ground. If there is no valid VCC (+15V output of the Switching Power Supply), Q15 turns on and activates the FAILURE alarm (both audible and visual, located on the Display/Switch Panel PCB) if there is sufficient voltage present on either the battery or power applied to the external power jack. Absence of VCC can be due to blown fuse(s), low external power voltage and low battery voltage, or due to a defect in the Switching Regulator. Fuses are monitored by Q4 (battery) and Q5 (external power) and associated components. If for example the battery fuse is blown but the battery voltage is valid, the emitter of Q4 (2N3906: PNP) is at a high voltage (BATT+ signal). However, the fused side of the battery has no voltage, and is connected to ground via R63, R64. Even though R63 and R64 are of very high value, enough current flows to turn on Q4. Current flows through D12 and R23 to the parallel combination of D16 (1N5242: 12V zener diode) and voltage divider R25, R26. The output of this circuit is the FUSEFLT signal which is monitored by the CPU. If the FUSEFLT signal rises above 0V, the CPU knows that a fuse is blown (if the other power source is valid and the CPU is running). Since the CPU knows which power source is in use (via the PWRSEL signal derived from the PWRCTL signal on the Motor Drive PCB), it knows which fuse is blown and displays the appropriate message. The CPU also monitors the voltage levels of FBATT+ (fused battery voltage) and FEXT+ (fused external power voltage) via the voltage dividers R63,R64 and R52,R53. The signals VBATT and VEXTPWR are the outputs of the voltage dividers that are actually monitored by the CPU, and are used to display low voltage warnings.

f. EL SUPPLY

The EL Supply (T2) is an inverter circuit that produces approximately 100VAC from 15VDC. It is used to power the backlight on the LCD display.

6. FLOW MANIFOLD (703-0754-01)

The Flow Manifold contains two pairs of variable orifice valves. Each pair controls the flow of external air or oxygen. The Flow Manifold also contains two gauge pressure sensors that monitor the tank pressure of the external gas sources, and three differential pressure transducers that are used for flow sensing.

7. EXHAUST MANIFOLD (703-0754-04)

The Exhaust Manifold has three 3-way solenoid valves that control the exhalation valve on the patient circuit. The center valve is a redundant backup valve, and under normal operation remains inactive.

8. COMPRESSOR (041-0021-00)

The Compressor consists of a brushless DC motor and a diaphragm pump.

9. AUTOCAL VALVE (704-0754-07)

The Autocal Valve is a 3-way solenoid valve that momentarily disconnects the patient circuit pressure transducer from the pneumatic circuits and vents it to ambient pressure during automatic calibration of the transducer. This operation is performed at 5-minute intervals, and lasts for a few hundred milliseconds.

10. UNIVERSAL AC POWER SUPPLY (703-0754-08)

The Universal AC Power Supply operates over an input voltage range of 90 – 250VAC, and generates a DC output voltage of nominally 12 Volts. It also incorporates a standard 9-pin RS-232 connector. This connector allows the ventilator to interface with the RS-232 port of a computer. The actual power supply module (024-0002-00) is not user serviceable, and must be replaced as a module.

11. UNIVERSAL AC POWER SUPPLY WITH DC-DC CONVERTER (703-0754-09)

The Universal AC Power Supply with DC-DC Converter contains two separate power supply modules. Module 1 is an AC power supply that operates over an input voltage range of 90 – 250VAC, 47-440Hz, and generates a DC output voltage of nominally 12 Volts. Module 2 is a DC-DC converter that operates over an input voltage range of 20 – 36VDC, and generates a DC output voltage of nominally 12 Volts. The Universal AC Power Supply with DC-DC Converter also incorporates a standard 9-pin RS-232 connector. This connector allows the ventilator to interface with the RS-232 port of a computer. Both power supply modules (AC Power Supply: 024-0002-00, DC-DC Converter: 026-0004-00) are not user serviceable, and must be replaced as modules.

NOTE

Waveforms and voltage measurements have been noted at various locations on each schematic drawing. In most cases, considerable leeway has been given as to what constitutes an acceptable voltage value in order to maintain device performance over a broad range of conditions.

PREVENTATIVE MAINTENANCE

(Refer to ROUTINE CARE AND MAINTENANCE, Section 6, in the Operation portion of this manual)

Preventative maintenance inspections (PMI) should be incorporated on a routine basis to insure proper device performance. These inspections should consist of both visual and performance checks, and cleaning when warranted.

PREVENTATIVE MAINTENANCE INSPECTIONS: should be made as follows:

- If monthly usage is less than 50 hours - PMI bimonthly.
- If monthly usage is greater than 100 hours - PMI monthly.

VISUAL CHECKS: Visual checks should include, but not be limited to:

1. Inspect hose, and hose fittings for cracks, crimps, leakage, and general wear. Replace defective hose.
2. If using Reusable Patient Valve, inspect connecting tubing, fittings and Patient Valve Assembly for cracks, crimps, leakage and general wear. Replace defective tubing. Repair and/or replace fittings and Patient Valve component parts as necessary.
3. Check battery recharging accessory cables for worn, cracked or exposed wires. Repair and/or replace cables with worn, cracked or exposed wires.
4. Check Control Module Case for wear, loose or missing hardware and cracks. Replace missing hardware. Tighten loose hardware. Repair and/or replace worn or damaged component parts.

PERFORMANCE CHECKS: Performance checks should include, but not be limited to:

1. Check for tactile feel and operation of <u>all</u> switches and controls.
2. Check the various operating modes (refer to the OPERATOR PERFORMANCE CHECKS section in the OPERATION portion of this manual).

CLEANING: Refer to the ROUTINE CARE AND MAINTENANCE "CLEANING" section in the OPERATION portion of this manual.

TROUBLESHOOTING GUIDE

The following Troubleshooting Guide describes symptoms and their possible causing condition(s). It is strongly recommended that servicing personnel read, and become thoroughly familiar with the operation of this device.

INDICATOR PROBLEMS

1. Check for defective LED
   Check for appropriate signal to LED

2. Check for defective Buzzer
   Check for appropriate signal to Buzzer

3. Check for defective LCD
   Check for defective LCD backlight
   Check for defective LCD backlight sensor
   Verify that LCD backlight is plugged in

4. Check for component failure on Display/Switch Panel PCB

5. Check integrity of "through connections"

CONTROL PROBLEMS

1. Check for defective rotary switch on Display/Switch Panel PCB
   Check connector to CPU PCB
   Check ribbon cable for shorts or opens

2. Check for defective pushbutton switch on Display/Switch Panel PCB
   Check connector to CPU PCB
   Check ribbon cable for shorts or opens

3. Check for defective potentiometer on Display/Switch Panel PCB
   Check connector to CPU PCB
   Check ribbon cable for shorts or opens

4. RS-232
   Check connector to CPU PCB
   Check U1, L1, L2, EEPROM (U5), and J3

ALARM PROBLEMS

1. Check U1-3, 8

2. Variable Orifice Valves clogged or defective

GAS DELIVERY PROBLEMS

1. Check for defective EPLD (U6)

2. Check Flow Manifold
   Check for defective Transducers
   Check for leaks
   Variable Orifice Valves clogged or defective

3. Check Compressor
   Check for proper output flows
   Check for leaks

4. Check Exhaust Manifold
   Check for leaks
   Exhaust valve(s) defective

5. Antiasphyxia valve not seated or missing

6. Internal hose(s) not connected or leaking

7. Defective Ventilator Circuit

POWER PROBLEMS

1. Check for defective Mode Switch

2. Check Battery Pack

3. Check integrity of "through connections"

4. Check fuses and fuseholders

5. Defective Compressor

6. Defective AC Power Supply

7. Defective DC Power Cable

8. Inadequate AC Mains voltage

BACKUP VENTILATOR PROBLEMS

1. Check EPLD (U6)

TECHNICAL DOCUMENTATION

NOTE: REFER TO APPLICABLE BILL OF MATERIAL FOR PART NUMBER DESCRIPTION.

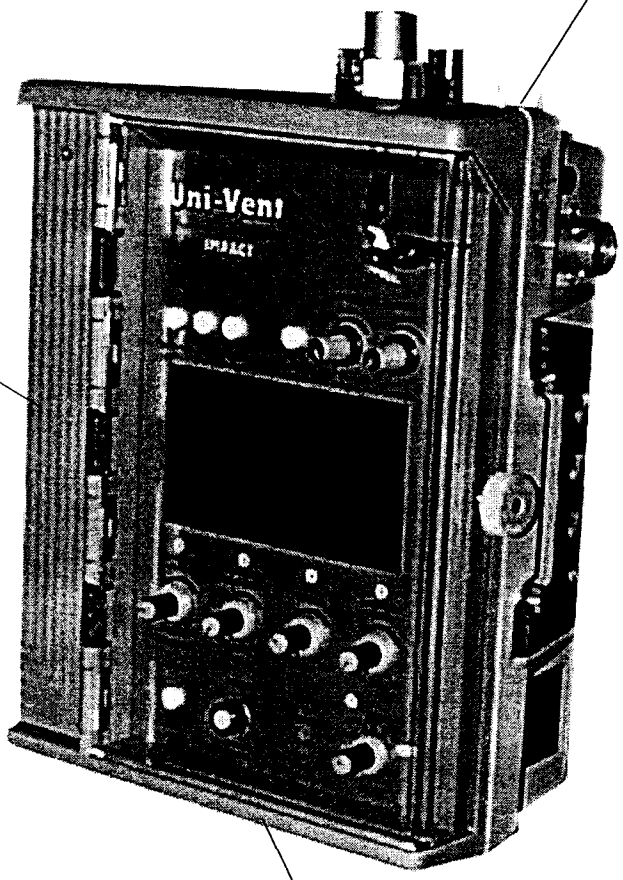
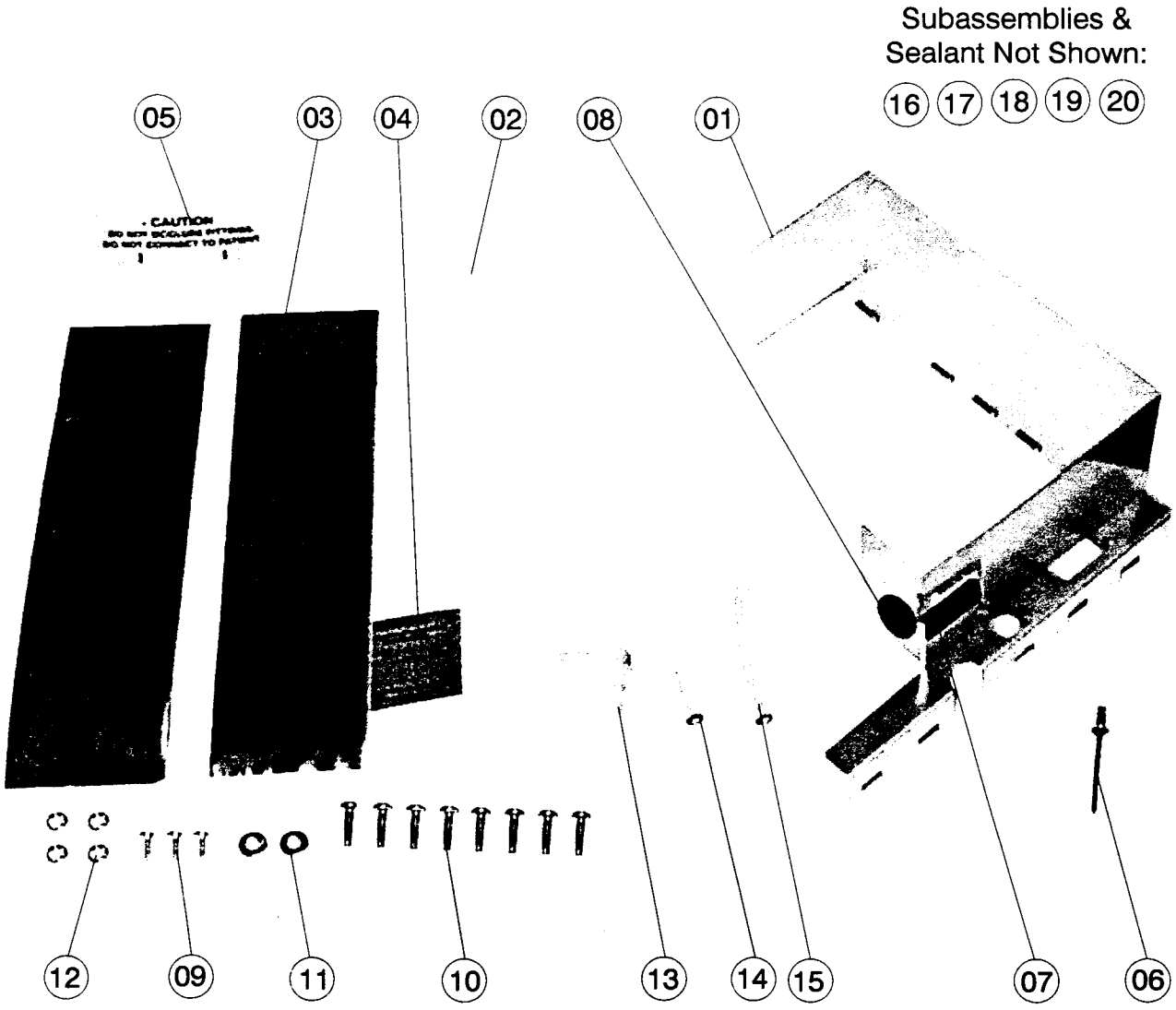


FIGURE 6, COMPOSITE ILLUSTRATION DEPICTING MAJOR SUB-ASSEMBLIES

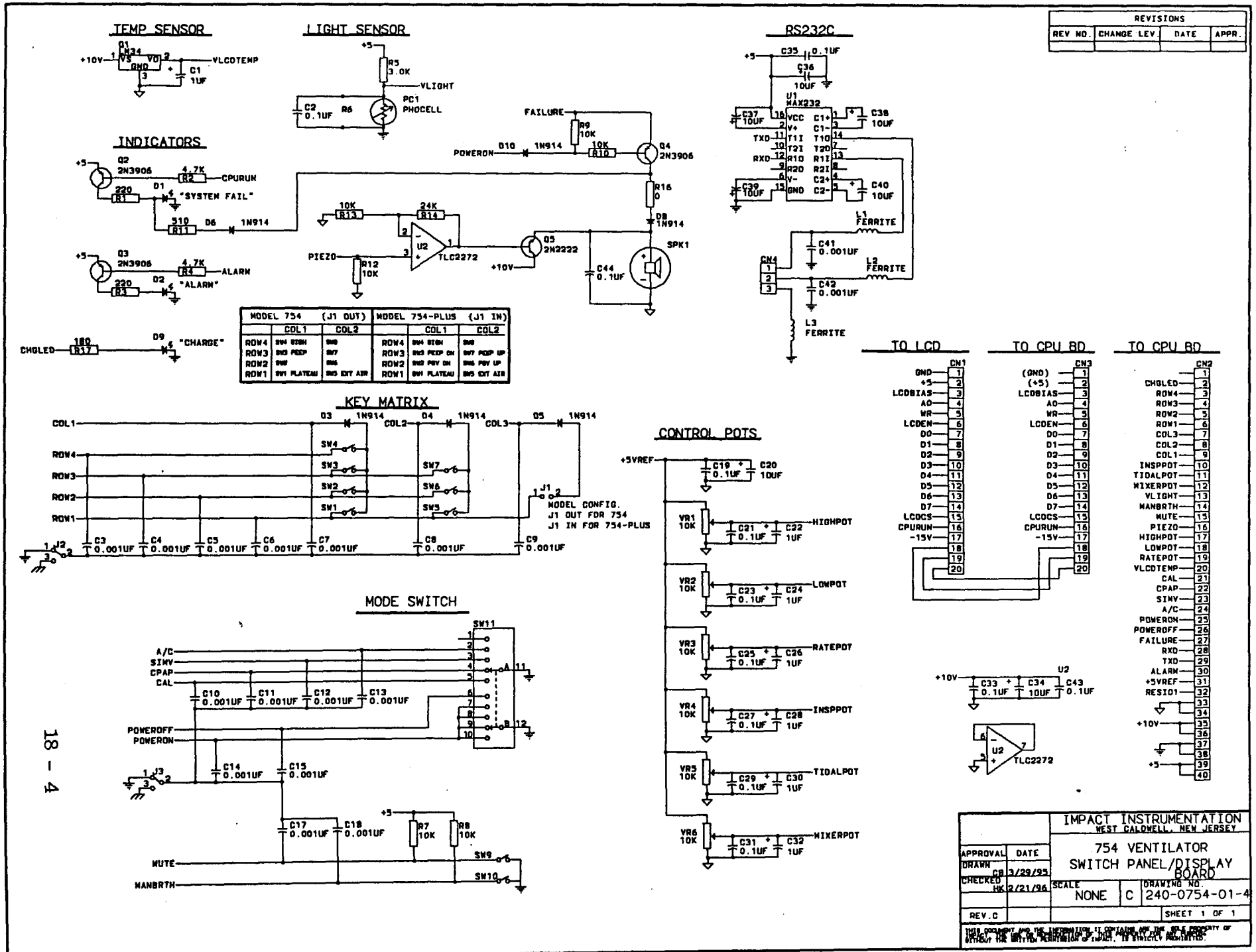


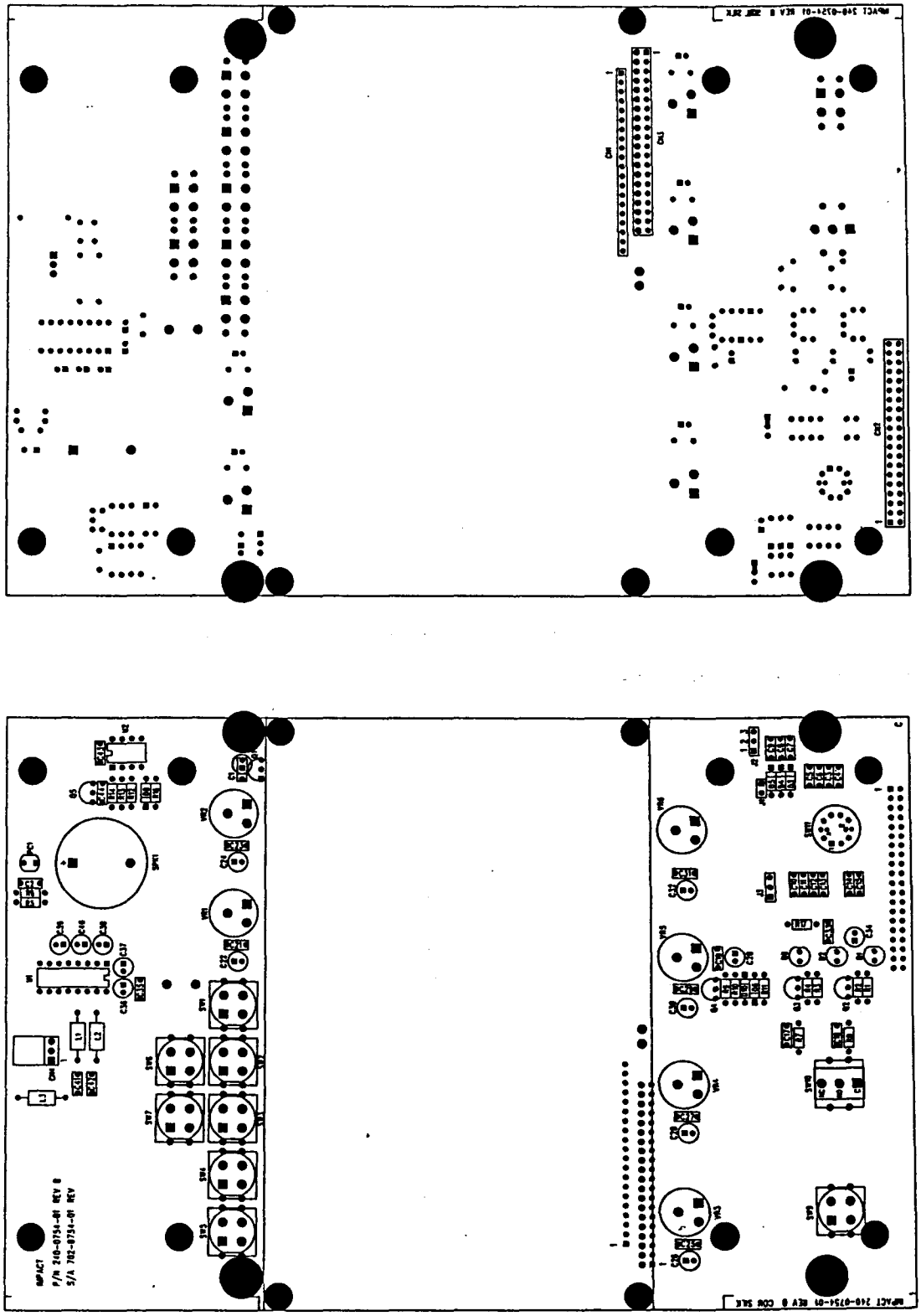
ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	310-0754-01	8	340-0064-00	15	540-0140-00
2	312-0041-00	9	358-0440-05	16	602-0005-00
3	312-0073-00	10	358-0632-08	17	703-0754-05
	325-0754-06	11	376-0007-00	18	703-0754-06
5	325-0754-07	12	376-0019-00	19	703-0754-07
6	338-0004-00	13	480-0253-00	20	704-0754-01
7	340-0063-00	14	540-0139-00		

SEE BILL OF MATERIAL 701-0754-01 (PAGE 18 - 3) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 7, FINAL MECHANICAL ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	310-0754-01	SHIELD, EMI	N/A
2	2	312-0041-00	TAPE, FOAM, WHITE, P/S, 1 1/2" LG	N/A
3	2	312-0073-00	TAPE, COPPER, 2" W X 8" LG	N/A
4	1	325-0754-06	LABEL, CALIBRATION/PMI	N/A
5	1	325-0754-07	LABEL, CAUTION	N/A
6	1	338-0004-00	RIVET	N/A
7	1	340-0063-00	GROMMETING, .875 LG	N/A
8	1	340-0064-00	GROMMET, 5/8" DIA.	N/A
9	3	358-0440-05	SCREW, PH, PAN HD, 4-40 X 5/16	N/A
10	8	358-0632-08	SCREW, PH, PAN HD, 6-32 X 1/2	N/A
11	2	376-0007-00	WASHER, FLAT, #6	N/A
12	4	376-0019-00	WASHER, LOCK, INTERNAL TOOTH, #4	N/A
13	1	480-0253-00	ELBOW, NYLON, WHITE, 1/8" TUBE X 1/8" TUBE	N/A
14	1	540-0139-00	HOSE, TYGON, 1/8" ID X 1/4" OD X 1/2" LG	N/A
15	1	540-0140-00	HOSE, TYGON, 1/8" ID X 1/4" OD X 2" LG	N/A
16	A/R	602-0005-00	SEALANT, SILICONE RUBBER, RTV	N/A
17	1	703-0754-05	ASSY, LOWER CASE	N/A
18	1	703-0754-06	ASSY, UPPER CASE	N/A
19	1	703-0754-07	ASSY, POWER SUPPLY, STANDARD	N/A
20	1	704-0754-01	ASSY, BATTERY PACK	B1/B2


TEMP SENSOR
LIGHT SENSOR
RS232C
INDICATORS
KEY MATRIX
MODE SWITCH
CONTROL POTS
TO LCD
TO CPU BD
TO CPU BD
REVISIONS
REV NO. | CHANGE LEV. | DATE | APPR.
MODEL 754 (J1 OUT) | MODEL 754-PLUS (J1 IN)
MODEL CONFIG.
J1 OUT FOR 754
J1 IN FOR 754-PLUS
IMPACT INSTRUMENTATION
WEST CALDWELL, NEW JERSEY
754 VENTILATOR
SWITCH PANEL/DISPLAY
BOARD
DRAWING NO. 240-0754-01-4
SCALE NONE
REV.C
SHEET 1 OF 1



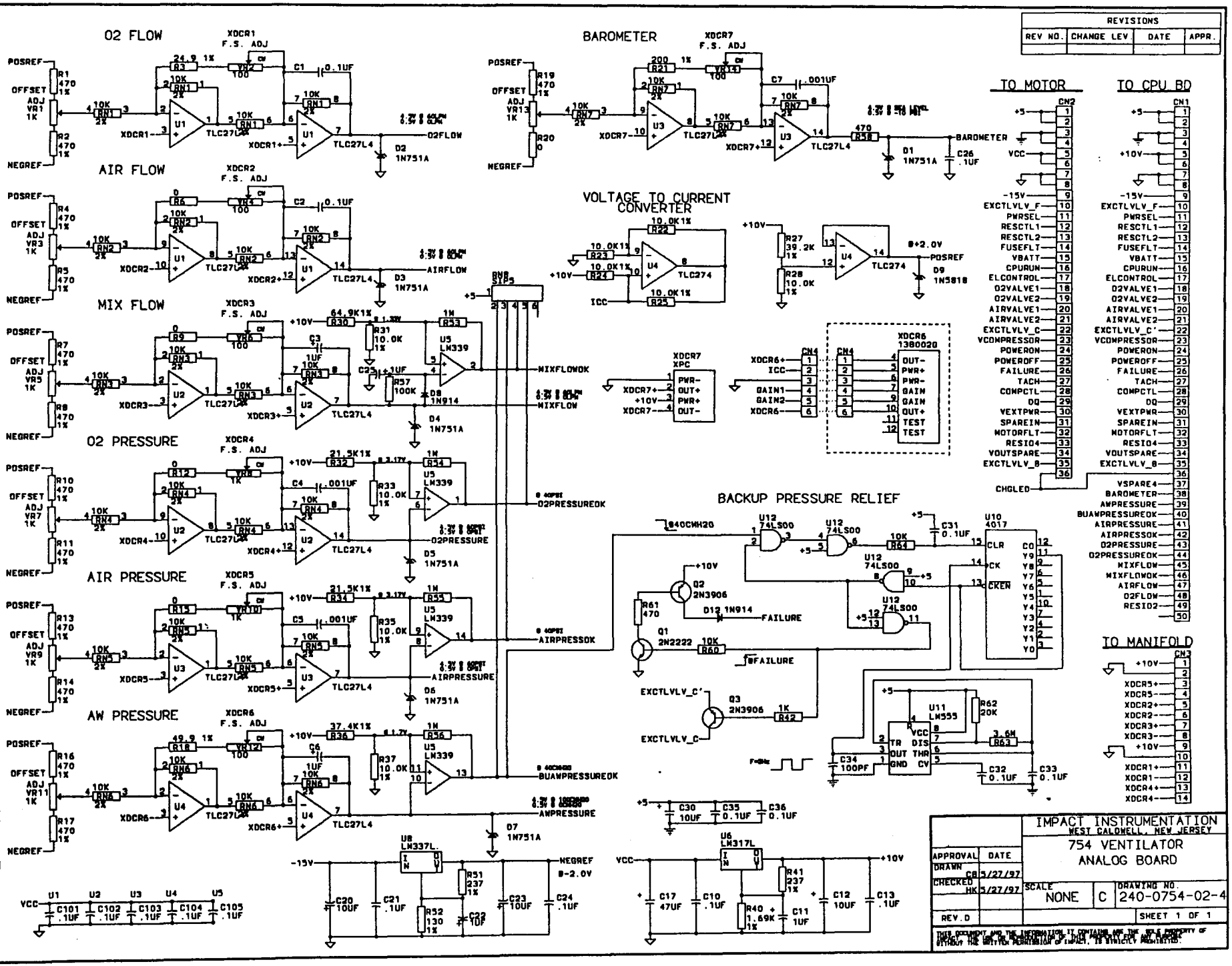
SOLDER SIDE VIEW

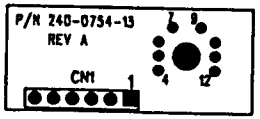
COMPONENT SIDE VIEW

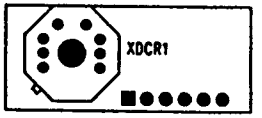
FIGURE 9, ASSEMBLY, DISPLAY/SWITCH PANEL PCB

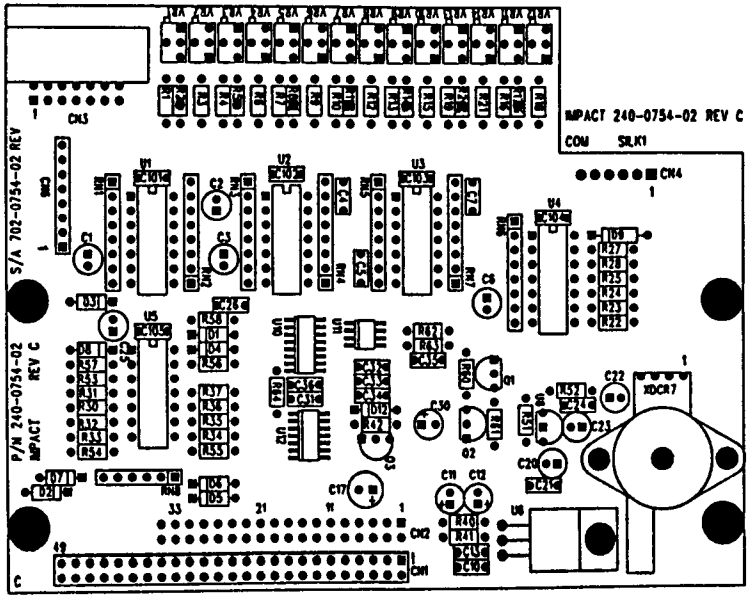
ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	027-0010-00	SPEAKER, PIEZO	SPK1
2	3	029-0006-00	INDUCTOR, FERRITE, 1 1/2 TURN	L1,2,3
3	6	047-0914-00	DIODE, SIGNAL, 1N914	D3-6,8,10
4	1	051-2222-00	TRANSISTOR, NPN, 2N2222	Q5
5	3	051-3906-00	TRANSISTOR, PNP, 2N3906	Q2,3,4
6	1	055-0004-00	IC, TEMP SENSOR, LM34DZ	Q1
7	1	055-0232-00	IC, RS232 RCVR/DRVR, MAX232	U1
8	1	055-2272-00	IC, DUAL OP-AMP, TLC2272	U2
9	1	067-0001-00	DISPLAY, LCD, GRAPHICS, BACKLIT	DSPLY1
10	2	068-0010-00	LED, RED, T1	D1,2
11	1	068-0011-00	LED, GREEN, T1	D9
12	1	073-0002-00	PHOTOCELL	PC1
13	20	092-0009-00	PIN, SOLDER	N/A
14	1	093-0042-20	CONNECTOR, 20-PIN M, HDR, 1-ROW	A1-A20
15	1	093-0055-20	CONNECTOR, 20-PIN F, STR HDR, 1-ROW	CN1
16	1	093-0056-20	CONNECTOR, 20-PIN F, THRU SKT, 1-ROW	CN3
17	1	093-0057-40	CONNECTOR, 40-PIN F, STR HDR, 2-ROW	CN2
18	1	093-0058-03	CONNECTOR, 3-PIN, RA, HDR	CN4
19	1	093-0061-02	CONNECTOR, PLUG, 2-PIN, IDC	N/A
20	1	109-0008-00	SOCKET, 8-PIN, HI-REL	N/A
21	1	109-0010-00	SOCKET, 16-PIN, HI-REL	N/A
22	1	117-0015-01	SWITCH, ROTARY, 2-POLE, 5-POS	SW11
23	1	121-0006-00	SWITCH, PUSHBUTTON W/CAP	SW10
24	5	121-0009-00	SWITCH, PUSHBUTTON	SW1,3,4,5,9
25	1	201-0000-02	RES, C.F., 0 OHM, 1/8W, 5%	R16
26	6	201-0103-02	RES, C.F., 10K, 1/8W, 5%	R7-10,12,13
27	1	201-0181-02	RES, C.F., 180 OHM, 1/8W, 5%	R17
28	2	201-0221-02	RES, C.F., 220 OHM, 1/8W, 5%	R1,3
29	1	201-0243-02	RES, C.F., 24K, 1/8W, 5%	R14
30	1	201-0302-02	RES, C.F., 3K, 1/8W, 5%	R5
31	2	201-0472-02	RES, C.F., 4.7K, 1/8W, 5%	R2,4
32	1	201-0511-02	RES, C.F., 510 OHM, 1/8W, 5%	R11
33	6	214-0103-01	POT, 1-TURN, 10K, 1/2W	VR1-6
34	1	240-0754-01	PCB, 2-LAYER, SWITCH PANEL	N/A
35	7	253-1056-51-1	CAP, ELECT, 1UF, 50V, KA	C1,22,24,26,28,30,32
36	7	253-1066-41-1	CAP, ELECT, 10UF, 35V, KA	C20,34,36-40
37	12	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C2,19-35(ODD),43,44
38	17	266-1024-51	CAP, CERAMIC, .001UF, 5%, 50V	C3-15,17,18,41,42
39	1	312-0079-00	TAPE, FOAM, WHITE, P/S, 5 1/4" LG	N/A
40	2	340-0067-00	GASKET, EMI, P/S, .150" X .150" X 5.1"	N/A
41	2	340-0068-00	GASKET, EMI, P/S, .150" X .150" X 3.3"	N/A
42	4	346-0440-01	NUT, KEPS, 4-40	N/A
43	4	358-0440-06	SCREW, PH, PAN HD, 4-40 X 3/8	N/A
44	4	368-0032-00	SPACER, NYLON, #4 X .250 OD X .125 H	N/A
45	A/R	600-0003-00	GLUE, HOT MELT	N/A
46	1	700-0754-01	JUMPER, 22 AWG, BROWN, 12"	N/A
47	1	700-0754-02	JUMPER, 22 AWG, BROWN, 12"	N/A

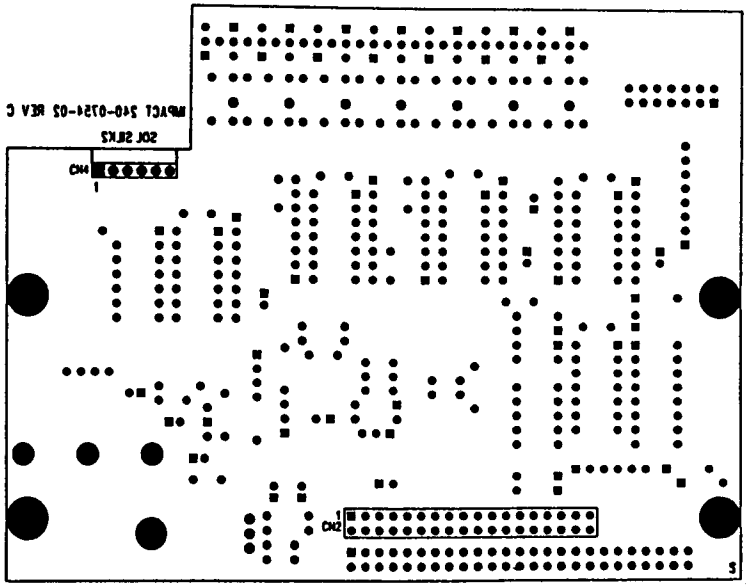
BILL OF MATERIAL:
702-0754-01
DISPLAY/SWITCH PANEL PCB


REVISIONS
REV NO. | CHANGE LEV | DATE | APPR.
O2 FLOW
BAROMETER
AIR FLOW
VOLTAGE TO CURRENT CONVERTER
MIX FLOW
O2 PRESSURE
BACKUP PRESSURE RELIEF
AIR PRESSURE
AW PRESSURE
TO MOTOR
TO CPU BD
TO MANIFOLD
IMPACT INSTRUMENTATION
WEST CALDWELL, NEW JERSEY
754 VENTILATOR
ANALOG BOARD
APPROVAL | DATE
DRAWN CB 5/27/97
CHECKED HK 5/27/97
REV. D
SCALE NONE
C
DRAWING NO. 240-0754-02-4
SHEET 1 OF 1









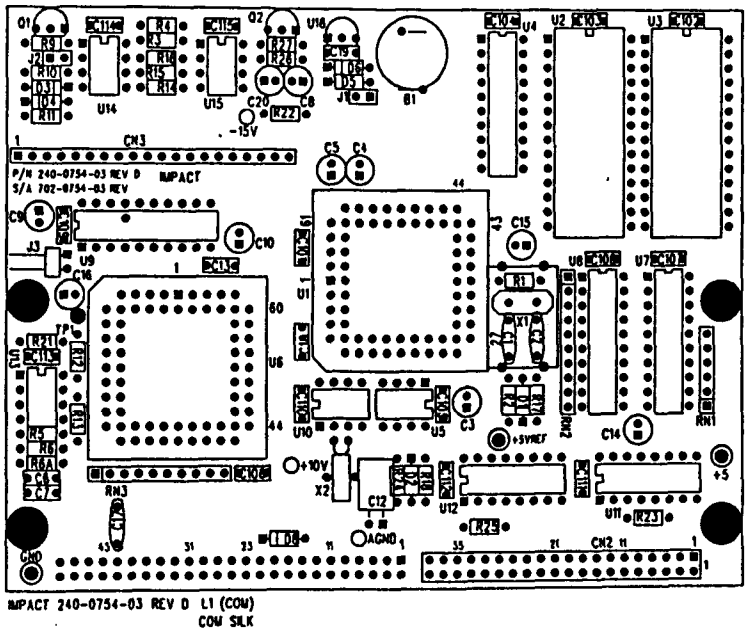
COMPONENT SIDE VIEW

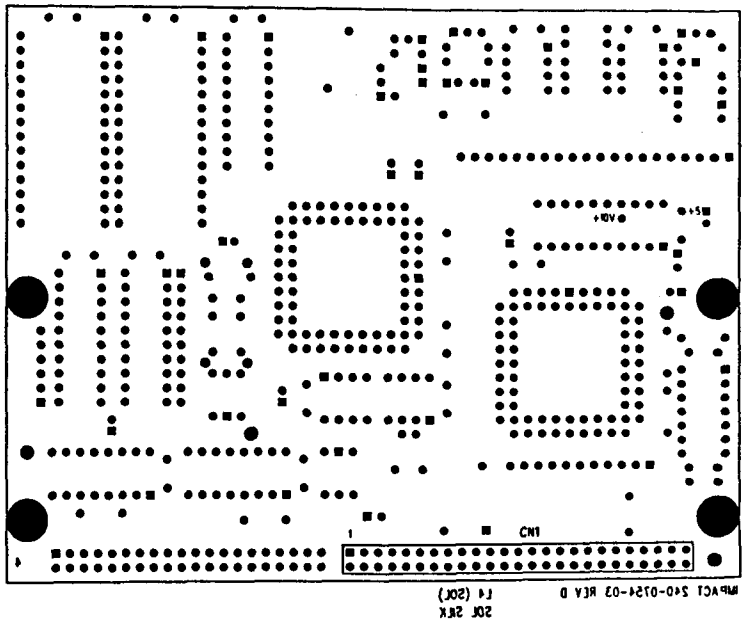
SOLDER SIDE VIEW

FIGURE 11, ASSEMBLY, ANALOG PCB

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	047-0914-00	DIODE, SIGNAL, 1N914	D8
2	1	047-0914-00	DIODE, SIGNAL, 1N914	D12
3	1	047-5818-00	DIODE, SCHOTTKEY, 1N5818	D9
4	7	049-5231-05	DIODE, ZENER, 5.1V	D1-7
5	1	051-2222-00	TRANSISTOR, NPN, 2N2222	Q1
6	2	051-3906-00	TRANSISTOR, PNP, 2N3906	Q2,3
7	4	055-0274-00	IC, LP QUAD OP-AMP, TLC27L4BIN	U1,2,3,4
8	1	055-0317-00	IC, ADJ VOLT REG, LM317T	U6
9	1	055-0337-00	IC, LM337LZ	U8
10	1	055-0339-00	IC, LP QUAD COMPARATOR, LM339N	U5
11	1	057-0555-00	IC, SMT, LM555	U11
12	1	057-4017-00	IC, SMT, 4017	U10
13	1	057-7400-00	IC, SMT, 74LS00	U12
14	1	093-0043-36	CONNECTOR, 36-PIN F, STR, 2-ROW	CN2
15	1	093-0051-14	CONNECTOR, 14-PIN, BOX, RA	CN3
16	1	093-0053-50	CONNECTOR, 50-PIN M, STR, 2-ROW	CN1
17	1	093-0054-06	CONNECTOR, 6-PIN, 1-ROW, RA	CN4
18	1	093-0075-08	CONNECTOR, 8-PIN M, RA HDR, 1-ROW	CN6
19	5	109-0007-00	SOCKET, 14-PIN, HI-REL	N/A
20	5	201-0000-02	RES, C.F., 0 OHM, 1/8W, 5%	R6,9,12,15,20
21	1	201-0102-02	RES, C.F., 1K, 1/8W, 5%	R42
22	2	201-0103-02	RES, C.F., 10K, 1/8W, 5%	R60,64
23	1	201-0104-02	RES, C.F., 100K, 1/8W, 5%	R57
24	4	201-0105-02	RES, C.F., 1M, 1/8W, 5%	R53-56
25	1	201-0203-02	RES, C.F., 20K, 1/8W, 5%	R62
26	1	201-0365-02	RES, C.F., 3.6M, 1/8W, 5%	R63
27	1	201-0471-02	RES, C.F., 470 OHM, 1/8W, 5%	R61
28	7	208-0103-04	RES, NTWK, 10K, 4-ELMT, 2%, ISOLATED	RN1-RN7
29	1	208-0103-05	RES, NTWK, 10K, 5-ELMT, 2%, COMMON	RN8
30	1	212-0240-90	RES, M.F., 24.9 OHM, 1/8W, 1%	R3
31	1	212-0490-90	RES, M.F., 49.9 OHM, 1/8W, 1%	R18
32	9	212-1002-00	RES, M.F., 10.0K, 1/8W, 1%	R22-25,28,31,33,35,37
33	1	212-1300-00	RES, M.F., 130 OHM, 1/8W, 1%	R52
34	1	212-1691-00	RES, M.F., 1.69K, 1/8W, 1%	R40
35	1	212-2000-00	RES, M.F., 200 OHM, 1/8W, 1%	R21
36	2	212-2152-00	RES, M.F., 21.5K, 1/8W, 1%	R32,34
37	2	212-2370-00	RES, M.F., 237 OHM, 1/8W, 1%	R41,51
38	1	212-3742-00	RES, M.F., 37.4K, 1/8W, 1%	R36
39	1	212-3922-00	RES, M.F., 39.2K, 1/8W, 1%	R27
40	8	212-4700-00	RES, M.F., 470 OHM, 1/8W, 1%	R1,2,4,5,7,8,10,11
41	6	212-4700-00	RES, M.F., 470 OHM, 1/8W, 1%	R13,14,16,17,19,58
42	1	212-6492-00	RES, M.F., 64.9K, 1/8W, 1%	R30
43	5	216-0101-00	POT, TRIM, MULTI-TURN, 100 OHM	VR2,4,6,12,14
44	9	216-0102-02	POT, TRIM, MULTI-TURN, 1K	VR1,3,5,7-11,13
45	1	240-0754-02	PCB, 2-LAYER, ANALOG	N/A
46	1	240-0754-13	PCB, 2-LAYER, TRANSDUCER	N/A
47	5	253-1056-51-1	CAP, ELECT, 1UF, 50V, KA	C3,6,11,22,25

48	3	253-1066-41-1	CAP, ELECT, 10UF, 35V, KA	C12,20,23
49	1	253-1066-41-1	CAP, ELECT, 10UF, 35V, KA	C30
50	1	253-4766-21	CAP, ELECT, 47UF, 25V, KA	C17
51	7	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C1,2,10,13,21,24,26
52	5	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C101-105
53	5	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C31,32,33,35,36
54	1	266-1003-12	CAP, CERAMIC, 100PF, 100V	C34
55	3	266-1024-51	CAP, CERAMIC, .001UF, 5%, 50V	C4,5,7
56	3	346-0440-01	NUT, KEPS, 4-40	N/A
57	1	358-0440-04	SCREW, PH, PAN HD, 4-40 X 1/4	N/A
58	2	358-0440-08	SCREW, PH, PAN HD, 4-40 X 1/2	N/A
59	1	804-0001-00	IC, PRESSURE XDCR, ICS 13B002G	XDCR6
60	1	804-0002-00	IC, PRESSURE XDCR, DI XPC15ATC	XDCR7

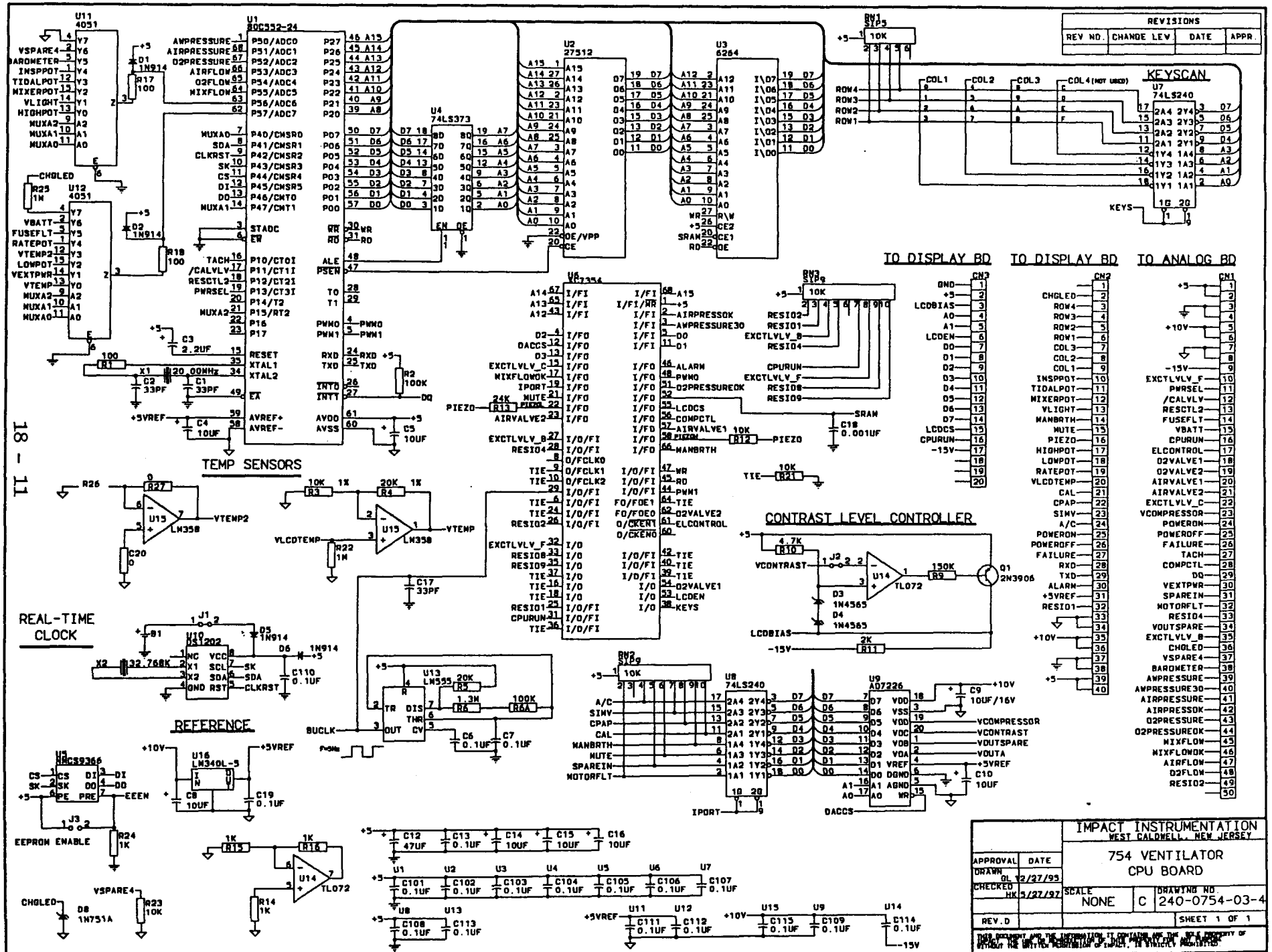




COMPONENT SIDE VIEW

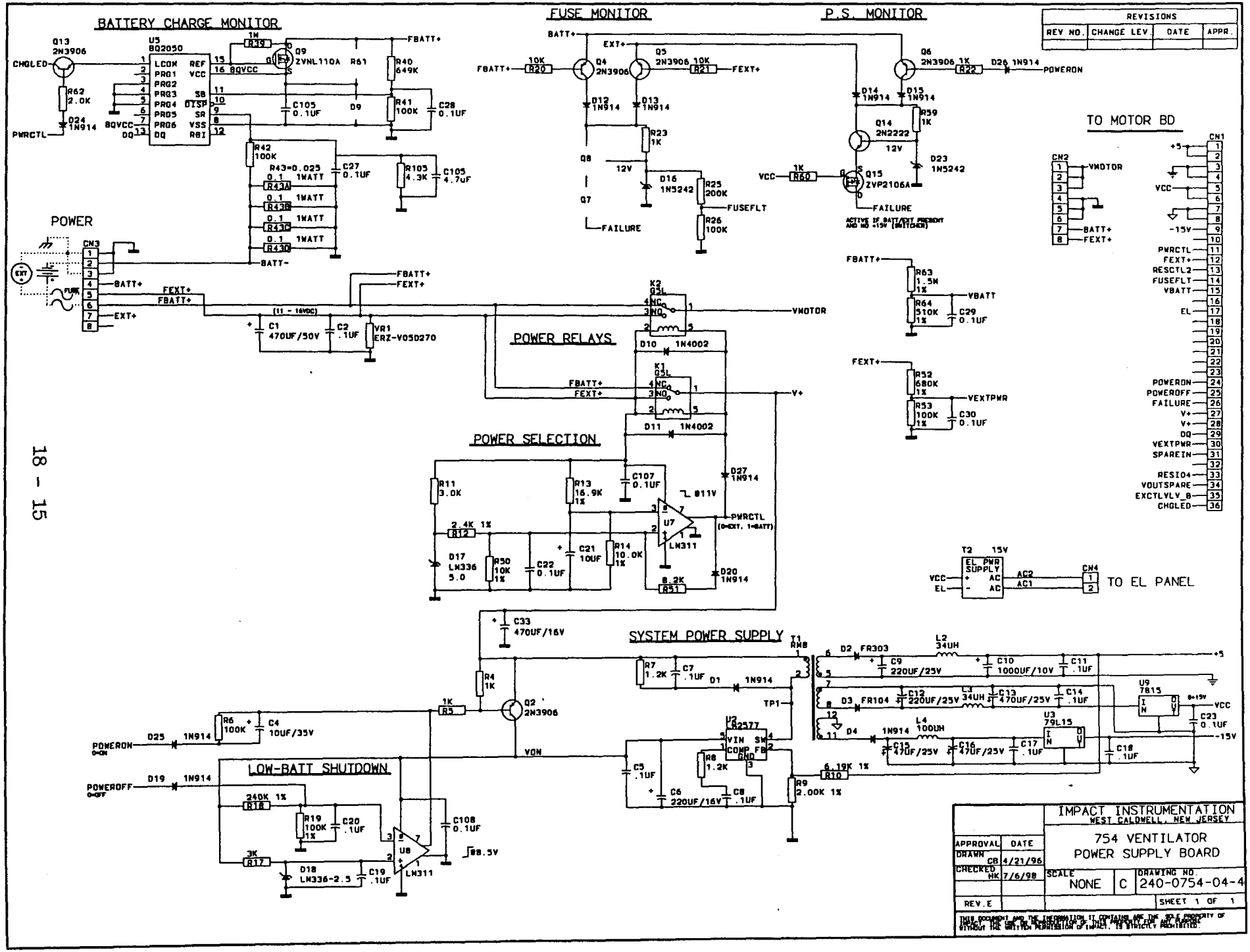
SOLDER SIDE VIEW

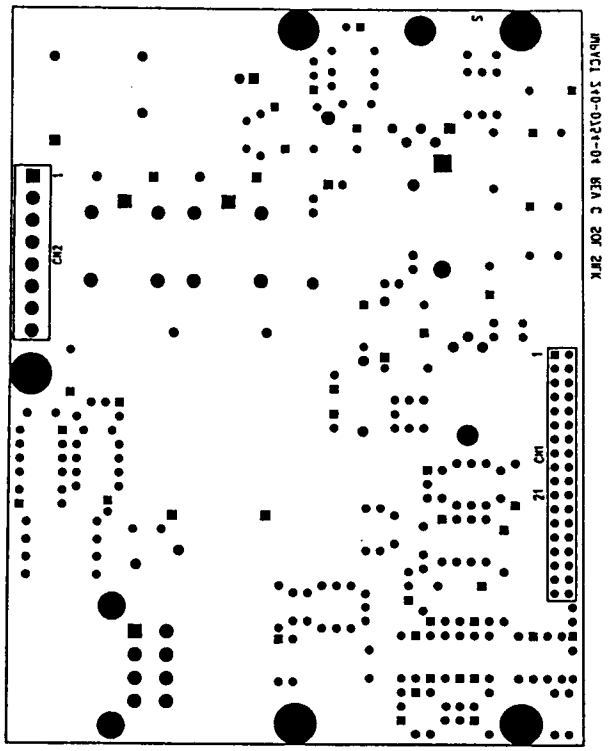
FIGURE 13, ASSEMBLY, CPU PCB


REVISIONS
REV NO. | CHANGE LEV | DATE | APPR.
KEYSCAN
TO DISPLAY BD
TO DISPLAY BD
TO ANALOG BD
TEMP SENSORS
CONTRAST LEVEL CONTROLLER
REAL-TIME CLOCK
REFERENCE
EEPROM ENABLE
IMPACT INSTRUMENTATION
WEST CALDWELL, NEW JERSEY
754 VENTILATOR
CPU BOARD
APPROVAL | DATE
DRAWN GL 12/27/95
CHECKED HK 5/27/97
SCALE NONE
C
DRAWING NO. 240-0754-03-4
REV. D
SHEET 1 OF 1
18 - 11

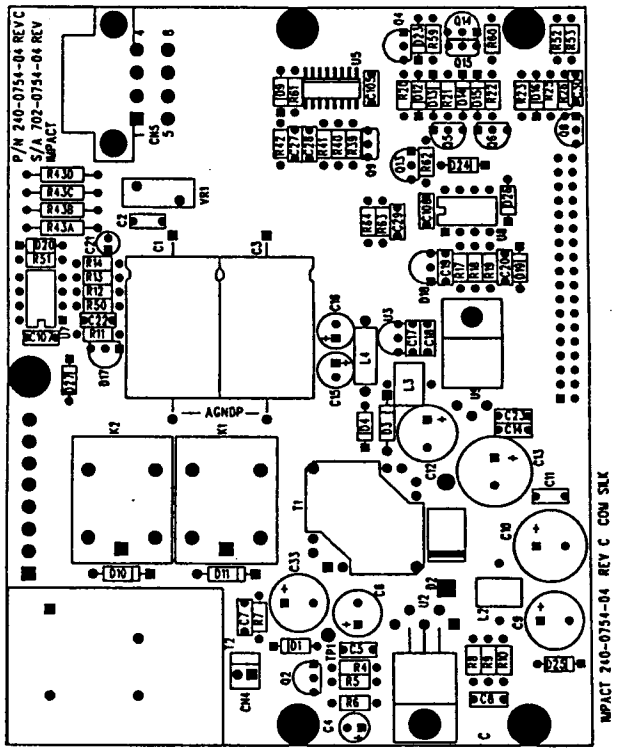
ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	2	012-0007-00	BUSSWIRE, 22 AWG, 1/2" LG	J1,2
2	1	021-0021-00	BATTERY, LITHIUM, 3.0V	B1
3	4	047-0914-00	DIODE, SIGNAL, 1N914	D1,2,5,6
4	2	049-4565-10	DIODE, ZENER, 1N4565	D3,4
5	1	049-5231-05	DIODE, ZENER, 5.1V	D8
6	1	051-3906-00	TRANSISTOR, PNP, 2N3906	Q1
7	2	053-7424-00	IC, TTL, OCTAL BUFFER, 74LS240	U7,8
8	1	053-7437-30	IC, TTL, OCTAL LATCH, 74LS373	U4
9	2	054-4051-00	IC, MUX, 4051	U11,12
10	1	054-7354-54	IC, CMOS, EPLD, XC7354	U6
11	1	055-0072-00	IC, DUAL OP-AMP, TL072	U14
12	1	055-0340-00	IC, VOLTAGE REGULATOR, LM340-5.0	U16
13	1	055-0358-00	IC, DIP, LM358N	U15
14	1	055-0555-00	IC, TIMER, LM555	U13
15	1	055-1202-00	IC, SERIAL CLOCK, DS1202	U10
16	1	055-2751-20	IC, PROM, 64K X 8, 27512	U2
17	1	055-6264-00	IC, STATIC RAM, 6264	U3
18	1	055-7226-00	IC, QUAD, 8-BIT, DAC, 807226	U9
19	1	055-8055-20	IC, 8-BIT MP W/PWM & A/D, 80C552	U1
20	1	055-9366-00	IC, SER EEPROM, 1024 BIT, NM93CS66N	U5
21	1	079-0003-00	CRYSTAL, 32.768 KHZ	X2
22	1	079-0004-00	CRYSTAL, 20.0 MHZ	X1
23	1	093-0040-40	CONNECTOR, 40-PIN M, HDR, 2-ROW	CN2
24	1	093-0041-50	CONNECTOR, 50-PIN F, SKT, 2-ROW	CN1
25	1	093-0042-20	CONNECTOR, 20-PIN M, HDR, 1-ROW	CN3
26	1	093-0076-02	CONNECTOR, 2-PIN M, RA HDR, 1-ROW	J3
27	5	109-0008-00	SOCKET, 8-PIN, HI-REL	N/A
28	2	109-0010-00	SOCKET, 16-PIN, HI-REL	N/A
29	4	109-0015-00	SOCKET, 20-PIN, HI-REL	N/A
30	2	109-0017-00	SOCKET, 28-PIN, HI-REL	N/A
31	2	109-0021-00	SOCKET, 68-PIN	N/A
32	2	201-0000-02	RES, C.F., 0 OHM, 1/8W, 5%	R27,C20 (BYPASS)
33	3	201-0101-02	RES, C.F., 100 OHM, 1/8W, 5%	R1,17,18
34	4	201-0102-02	RES, C.F., 1K, 1/8W, 5%	R14,15,16,24
35	3	201-0103-02	RES, C.F., 10K, 1/8W, 5%	R12,21,23
36	2	201-0104-02	RES, C.F., 100K, 1/8W, 5%	R2,6A
37	2	201-0105-02	RES, C.F., 1M, 1/8W, 5%	R22,25
38	1	201-0135-02	RES, C.F., 1.3M, 1/8W, 5%	R6
39	1	201-0154-02	RES, C.F., 150K, 1/8W, 5%	R9
40	1	201-0202-02	RES, C.F., 2K, 1/8W, 5%	R11
41	1	201-0203-02	RES, C.F., 20K, 1/8W, 5%	R5
42	1	201-0243-02	RES, C.F., 24K, 1/8W, 5%	R13
43	1	201-0472-02	RES, C.F., 4.7K, 1/8W, 5%	R10
44	2	208-0103-03	RES, NTWK, 10K, 9-ELMT, 2%, COMMON	RN2,3
45	1	208-0103-05	RES, NTWK, 10K, 5-ELMT, 2%, COMMON	RN1
46	1	212-1002-00	RES, M.F., 10.0K, 1/8W, 1%	R3
47	1	212-2002-00	RES, M.F., 20K, 1/8W, 1%	R4

48	1	240-0754-03	PCB, 4-LAYER, CPU	N/A
49	5	253-1066-41-1	CAP, ELECT, 10UF, 35V, KA	C4,5,8,9,10
50	1	253-2256-51	CAP, ELECT, 2.2UF, 50V, KA	C3
51	1	253-4766-11	CAP, ELECT, 47UF, 10V, HFS	C12
52	3	255-1066-11	CAP, TANTALUM, 10UF, 16V	C14,15,16
53	19	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C6,7,13,19,101-115
54	1	266-1024-51	CAP, FILM, .001UF, 5%, 50V	C18
55	3	266-3303-12	CAP, CERAMIC, 33PF, 5%, 50V	C1,2,17
56	1	310-0028-00	SHIELD, CRYSTAL, EMI/RFI	N/A


BATTERY CHARGE MONITOR
FUSE MONITOR
P.S. MONITOR
REVISIONS
REV NO. | CHANGE LEV | DATE | APPR.
TO MOTOR BD
POWER
POWER RELAYS
POWER SELECTION
SYSTEM POWER SUPPLY
LOW-BATT SHUTDOWN
TO EL PANEL
IMPACT INSTRUMENTATION
WEST CALDWELL, NEW JERSEY
754 VENTILATOR
POWER SUPPLY BOARD
SCALE NONE
C
240-0754-04-4
SHEET 1 OF 1
REV. E
APPROVAL | DATE
DRAWN CB 4/21/96
CHECKED HK 7/6/98



SOLDER SIDE VIEW

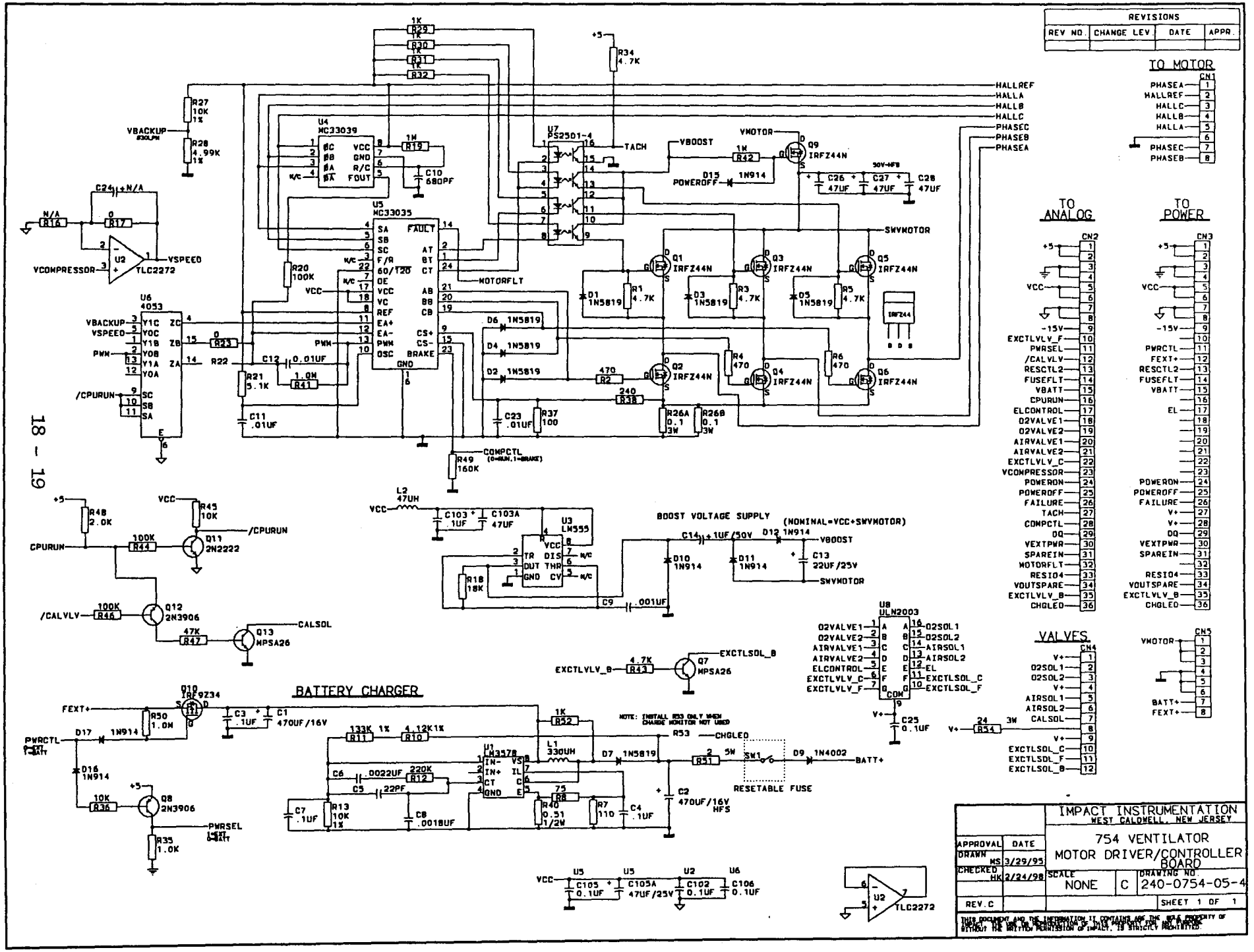


COMPONENT SIDE VIEW

FIGURE 15, ASSEMBLY, POWER PCB

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	023-0021-00	TRANSFORMER, RM8	T1
2	1	023-0022-00	POWER SUPPLY, LCD, EL, 15V	T2
3	2	029-0003-00	INDUCTOR, TOROIDAL, 36uh	L2,3
4	1	029-0005-00	INDUCTOR, RADIAL, 100uh	L4
5	2	037-0003-00	RELAY, SPST, N.O.	K1,2
6	1	047-0104-00	DIODE, RECT, FAST RECOVERY, FR104	D3
7	1	047-0303-00	DIODE, RECTIFIER, FR303	D2
8	12	047-0914-00	DIODE, SIGNAL, 1N914	D1,4,12-15,19,20,24-27
9	2	047-4002-00	DIODE, RECTIFIER, IN4002	D10,11
10	2	049-5242-20	DIODE, ZENER, 12V, 1N5242	D16,23
11	1	051-0110-00	TRANSISTOR, N-CHANNEL, ZVNL110A	Q9
12	1	051-2106-00	TRANSISTOR, P-CHNL, ZVP2106A	Q15
13	1	051-2222-00	TRANSISTOR, NPN, 2N2222	Q14
14	5	051-3906-00	TRANSISTOR, PNP, 2N3906	Q2,4,5,6,13
15	2	055-0311-00	IC, VOLTAGE COMPARATOR, LM311	U7,8
16	1	055-0336-00	IC, REF DIODE, ZENER, 2.5V, LM336-2.5	D18
17	1	055-0336-01	IC, REF DIODE, ZENER, 5.0V, LM336-5.0	D17
18	1	055-2577-00	IC, SWITCHING REGULATOR, LM2577	U2
19	1	055-7815-00	IC, REGULATOR, LM78M15CT	U9
20	1	055-7915-00	IC, NEG VOLTAGE REGULATOR, 79L15	U3
21	1	057-2050-00	IC, LITHIUM POWER GAUGE, BQ2050	U5
22	1	093-0044-08	CONNECTOR, 8-PIN M, ST, HDR	CN2
23	1	093-0046-02	CONNECTOR, 2-PIN, STR, HDR	CN4
24	1	093-0059-08	CONNECTOR, 8-PIN, RA, HDR, MINI FIT JR	CN5
25	1	093-0069-36	CONNECTOR, 36-PIN M, STR HDR, 2-ROW	CN1
26	2	109-0008-00	SOCKET, 8-PIN, HI-REL	N/A
27	6	201-0102-02	RES, C.F., 1K, 1/8W, 5%	R4,5,22,23,59,60
28	2	201-0103-02	RES, C.F., 10K, 1/8W, 5%	R20,21
29	4	201-0104-02	RES, C.F., 100K, 1/8W, 5%	R6,26,41,42
30	1	201-0105-02	RES, C.F., 1M, 1/8W, 5%	R39
31	2	201-0122-02	RES, C.F., 1.2K, 1/8W, 5%	R7,8
32	1	201-0202-02	RES, C.F., 2K, 1/8W, 5%	R62
33	1	201-0204-02	RES, C.F., 200K, 1/8W, 5%	R25
34	2	201-0302-02	RES, C.F., 3K, 1/8W, 5%	R11,17
35	1	201-0432-02	RES, C.F., 4.3K, 1/8W, 5%	R150
36	1	201-0822-02	RES, C.F., 8.2K, 1/8W, 5%	R51
37	4	209-00X5-02	RES, C.F., 0.1 OHM, 1W, 5%	R43A,43B,43C,43D
38	2	212-1002-00	RES, M.F., 10.0K, 1/8W, 1%	R14,50
39	2	212-1003-00	RES, M.F., 100.0K, 1/8W, 1%	R19,53
40	1	212-1504-00	RES, M.F., 1.5M, 1/8W, 1%	R63
41	1	212-1692-00	RES, M.F., 16.9K, 1/8W, 1%	R13
42	1	212-2001-00	RES, M.F., 2K, 1/8W, 1%	R9
43	1	212-2401-00	RES, M.F., 2.4K, 1/8W, 1%	R12
44	1	212-2403-00	RES, M.F., 240K, 1/8W, 1%	R18
45	1	212-5113-00	RES, M.F., 511K, 1/8W, 1%	R64
46	1	212-6191-00	RES, M.F., 6.19K, 1/8W, 1%	R10
47	1	212-6493-00	RES, M.F., 649K, 1/8W, 1%	R40

48	1	212-6803-00	RES, M.F., 680K, 1/8W, 1%	R52
49	1	230-0003-00	MOV, 22 VDC, 125A PEAK SURGE	VR1
50	1	240-0754-04	PCB, 2-LAYER, POWER	N/A
51	1	252-4776-51-1	CAP, ELECT, HFS, 470UF, 50V, AXIAL	C1
52	1	253-1066-41-1	CAP, ELECT, 10UF, 35V, KA	C4
53	1	253-1066-51	CAP, ELECT, SU, 10UF, 50V	C21
54	1	253-1086-11	CAP, ELECT, HFS, 1000UF, 10V	C10
55	1	253-2276-21	CAP, ELECT, SU, 220UF, 16V	C6
56	2	253-2276-31	CAP, ELECT, HFS, 220UF, 25V	C9,12
57	2	253-4766-31	CAP, ELECT, HFS, 47UF, 25V	C15,16
58	1	253-4776-21-1	CAP, ELECT, HFS, 470UF, 16V, RADIAL	C33
59	1	253-4776-31	CAP, ELECT, HFS, 470UF, 25V	C13
60	1	255-4756-11	CAP, TANT, 4.7UF, 10V	C150
61	11	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C2,5,7,8,11,14,17-20,22
62	8	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C23,27-30,105,107,108
63	1	346-0440-01	NUT, KEPS, 4-40	N/A
64	1	346-0440-05	NUT, NYLON, 4-40	N/A
65	2	358-0440-04	SCREW, PH, PAN HD, 4-40 X 1/4	N/A


REVISIONS
REV NO. | CHANGE LEV | DATE | APPR.
TO MOTOR
CN1
PHASEA
HALLREF
HALLC
HALLB
HALLA
PHASEC
PHASEB
HALLREF
HALLA
HALLB
HALLC
PHASEC
PHASEB
PHASEA
TO ANALOG
CN2
TO POWER
CN3
+5
VCC
-15V
EXCTLVLV_F
PWRSEL
/CALVLV
RESCTL2
FUSEFLT
VBATT
CPURUN
ELCONTROL
O2VALVE1
O2VALVE2
AIRVALVE1
AIRVALVE2
EXCTLVLV_C
VCONPRESSOR
POWERON
POWEROFF
FAILURE
TACH
COMPCTL
DQ
VEXTPWR
SPAREIN
MOTORFLT
RESIO4
VOUTSPARE
EXCTLVLV_B
CHGLED
EL
VBOOST
SWVMOTOR
VMOTOR
VALVES
CN4
CN5
V+
O2SOL1
O2SOL2
AIRSOL1
AIRSOL2
CALSOL
EXCTLSOL_C
EXCTLSOL_F
EXCTLSOL_B
BATT+
FEXT+
BATTERY CHARGER
BOOST VOLTAGE SUPPLY
(NOMINAL=VCC+SWVMOTOR)
RESETABLE FUSE
NOTE: INSTALL R53 ONLY WHEN CHARGE MONITOR NOT USED
IMPACT INSTRUMENTATION
WEST CALDWELL, NEW JERSEY
754 VENTILATOR
MOTOR DRIVER/CONTROLLER BOARD
APPROVAL | DATE
DRAWN MS 3/29/95
CHECKED HK 2/24/98
SCALE NONE
C
DRAWING NO. 240-0754-05-4
REV.C
SHEET 1 OF 1
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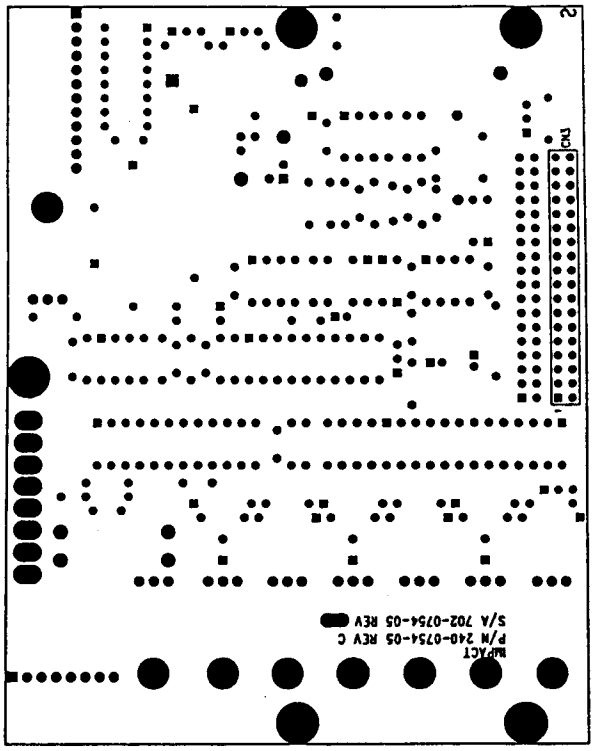
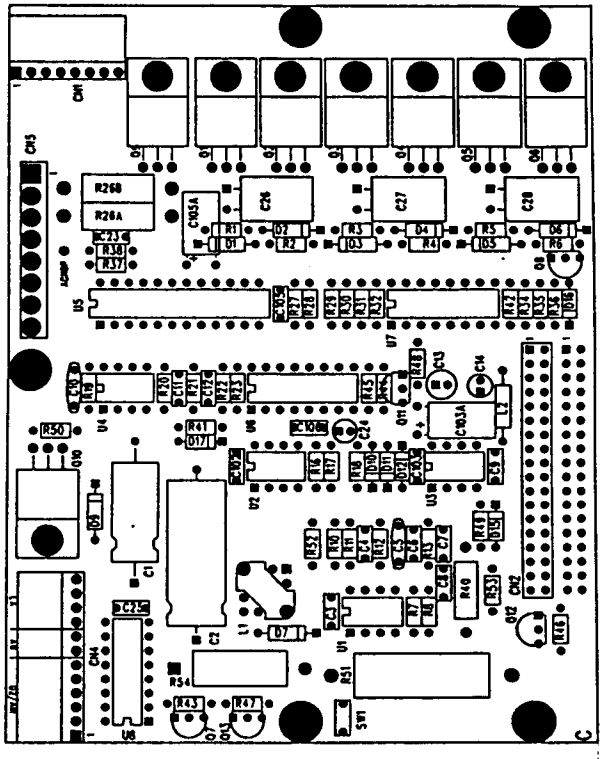


SOLDER SIDE VIEW

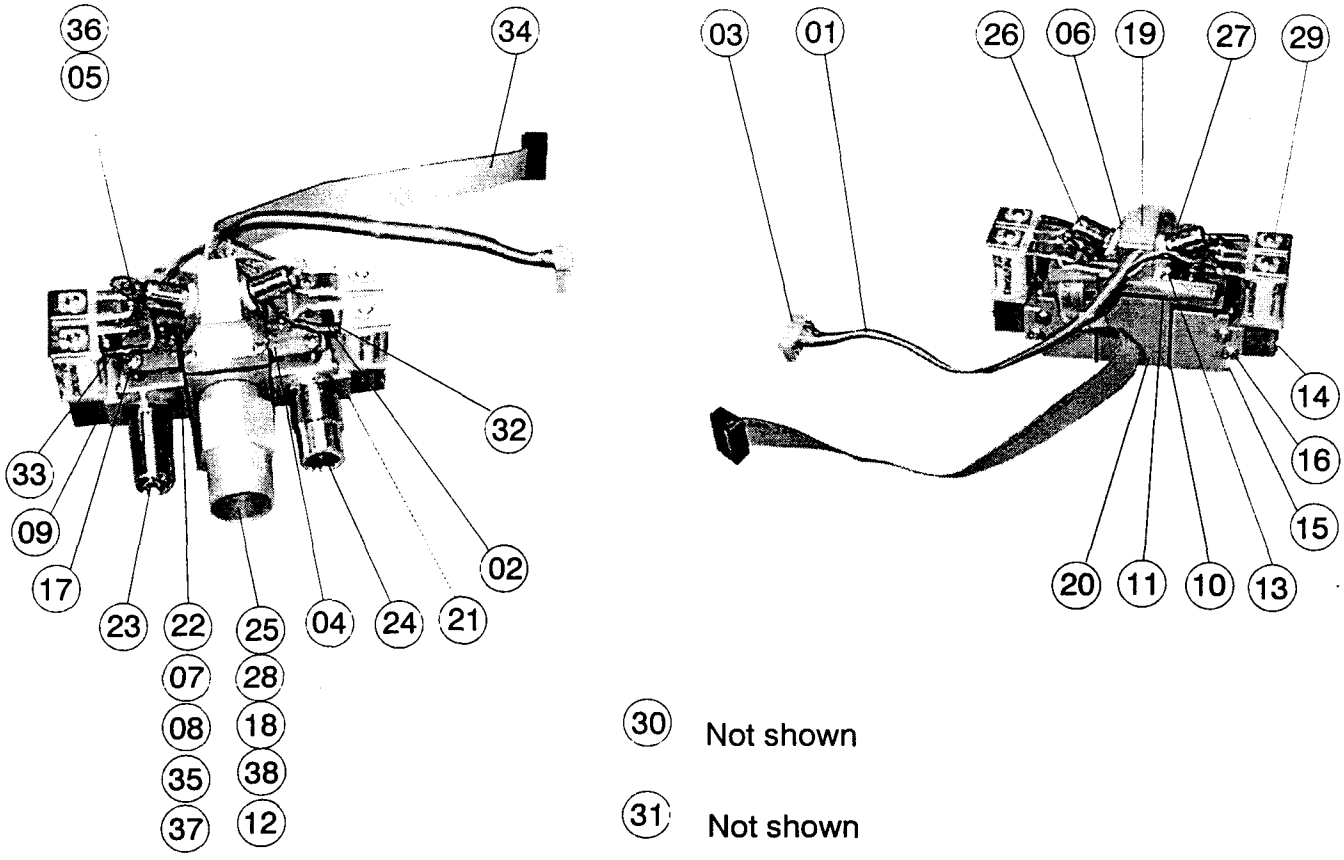


COMPONENT SIDE VIEW

FIGURE 17, ASSEMBLY, MOTOR DRIVE PCB

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	029-0012-00	INDUCTOR, 330uh, RM4 CORE	L1
2	1	029-0015-00	INDUCTOR, 47uh, MOLDED	L2
3	6	047-0914-00	DIODE, SIGNAL, 1N914	D10,11,12,15,16,17
4	1	047-4002-00	DIODE, RECTIFIER, IN4002	D9
5	7	047-5819-00	DIODE, SCHOTTKEY, 1N5819	D1-7
6	2	051-0026-00	TRANSISTOR, NPN, DRLNGTN, MPSA26	Q7,13
7	1	051-2222-00	TRANSISTOR, NPN, 2N2222	Q11
8	2	051-3906-00	TRANSISTOR, PNP, 2N3906	Q8,12
9	7	051-4400-00	TRANSISTOR, N-CHANNEL, IRFZ44N	Q1-6,9
10	1	051-9234-00	TRANSISTOR, P-CHANNEL, IRF9Z34	Q10
11	1	054-4053-00	IC, TRIPLE 2-CHNL MUX, CD4053	U6
12	1	055-0555-00	IC, TIMER, LM555	U3
13	1	055-2003-00	IC, PERIPHERAL DRIVER, ULN2003	U8
14	1	055-2272-00	IC, DUAL OP-AMP, TLC2272	U2
15	1	055-2501-40	IC, OPTOISOLATOR, PS2501-4	U7
16	1	055-3303-50	IC, DC MOTOR CTRL, MC33035	U5
17	1	055-3303-90	IC, MOTOR SPEED CTRL, MC33039	U4
18	1	055-3578-00	IC, 5V SWITCHING REG, LM3578	U1
19	1	093-0047-08	CONNECTOR, 8-PIN, RA, HDR, .1	CN1
20	1	093-0048-08	CONNECTOR, 8-PIN, SKT, THRU	CN5
21	1	093-0049-36	CONNECTOR, 36-PIN F, ST, SKT, 2-ROW	CN3
22	1	093-0069-36	CONNECTOR, 36-PIN M, STR HDR, 2-ROW	CN2
23	1	093-0077-12	CONNECTOR, 12-PIN, RA, HDR, .1	CN4
24	4	109-0008-00	SOCKET, 8-PIN, HI-REL	N/A
25	3	109-0010-00	SOCKET, 16-PIN, HI-REL	N/A
26	1	109-0022-00	SOCKET, 24-PIN, HI-REL	N/A
27	1	131-0011-00	FUSE, SELF-RESETTING, 1A	SW1
28	2	201-0000-02	RES, C.F., 0 OHM, 1/8W, 5%	R17,23
29	1	201-0101-02	RES, C.F., 100 OHM, 1/8W, 5%	R37
30	6	201-0102-02	RES, C.F., 1K, 1/8W, 5%	R29,30,31,32,35,52
31	2	201-0103-02	RES, C.F., 10K, 1/8W, 5%	R36,45
32	3	201-0104-02	RES, C.F., 100K, 1/8W, 5%	R20,44,46
33	4	201-0105-02	RES, C.F., 1M, 1/8W, 5%	R19,41,42, 50
34	1	201-0111-02	RES, C.F., 110 OHM, 1/8W, 5%	R7
35	1	201-0164-02	RES, C.F., 160K, 1/8W, 5%	R49
36	1	201-0183-02	RES, C.F., 18K, 1/8W, 5%	R18
37	1	201-0202-02	RES, C.F., 2K, 1/8W, 5%	R48
38	1	201-0224-02	RES, C.F., 220K, 1/8W, 5%	R12
39	1	201-0241-02	RES, C.F., 240 OHM, 1/8W, 5%	R38
40	3	201-0471-02	RES, C.F., 470 OHM, 1/8W, 5%	R2,4,6
41	5	201-0472-02	RES, C.F., 4.7K, 1/8W, 5%	R1,3,5,34,43
42	1	201-0473-02	RES, C.F., 47K, 1/8W, 5%	R47
43	1	201-0512-02	RES, C.F., 5.1K, 1/8W, 5%	R21
44	1	201-0750-02	RES, C.F., 75 OHM, 1/8W, 5%	R8
45	1	202-0005-01	RES, C.F., 0.51 OHM, 1/2W, 5%	R40
46	2	204-001X-02	RES, C.F., 0.1 OHM, 3W, 5%	R26A,26B
47	1	204-0240-02	RES, MTL OXIDE FILM, 24 OHM, 3W, 5%	R54

48	1	210-0020-00	RES, C.F., 2 OHM, 5W, 10%	R51
49	2	212-1002-00	RES, M.F., 10.0K, 1/8W, 1%	R13,27
50	1	212-1333-00	RES, M.F., 133K, 1/8W, 1%	R11
51	1	212-4121-00	RES, M.F., 4.12K, 1/8W, 1%	R10
52	1	212-4991-00	RES, M.F.,4.99K, 1/8W, 1%	R28
53	1	240-0754-05	PCB, 2-LAYER, MOTOR DRIVE	N/A
54	1	252-4776-21	CAP, ELECT, SU, 470UF, 16V	C1
55	1	252-4776-21-1	CAP, ELECT, HFS, 470UF, 16V, AXIAL	C2
56	1	253-1056-51-1	CAP, ELECT, 1UF, 50V, KA	C14
57	1	253-2266-31	CAP, ELECT, KA, 22UF, 25V	C13
58	3	253-4766-51-1	CAP, ELECT, HFS, 47UF, 50V	C26,27,28
59	2	255-4766-31	CAP, TANTALUM, 47UF, 25V	C103A,105A
60	3	259-1034-51	CAP, METAL FILM, .01UF, 5%, 50V	C11,12,23
61	4	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C3,4,7,25
62	4	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C102,103,105,106
63	1	259-1824-51	CAP, POLYSTR FILM, .0018UF, 5%, 50V	C8
64	1	259-2224-51	CAP, POLYSTR FILM, .0022UF, 5%, 50V	C6
65	1	259-6814-51	CAP, POLYSTR FILM, 680PF, 5%, 50V	C10
66	1	266-1024-51	CAP, FILM, .001UF, 5%, 50V	C9
67	1	266-2203-12	CAP, CERAMIC, 22 PF, 5%, 100V	C5
68	8	346-0440-01	NUT, KEPS, 4-40	N/A
69	8	358-0440-04	SCREW, PH, PAN HD, 4-40 X 1/4	N/A

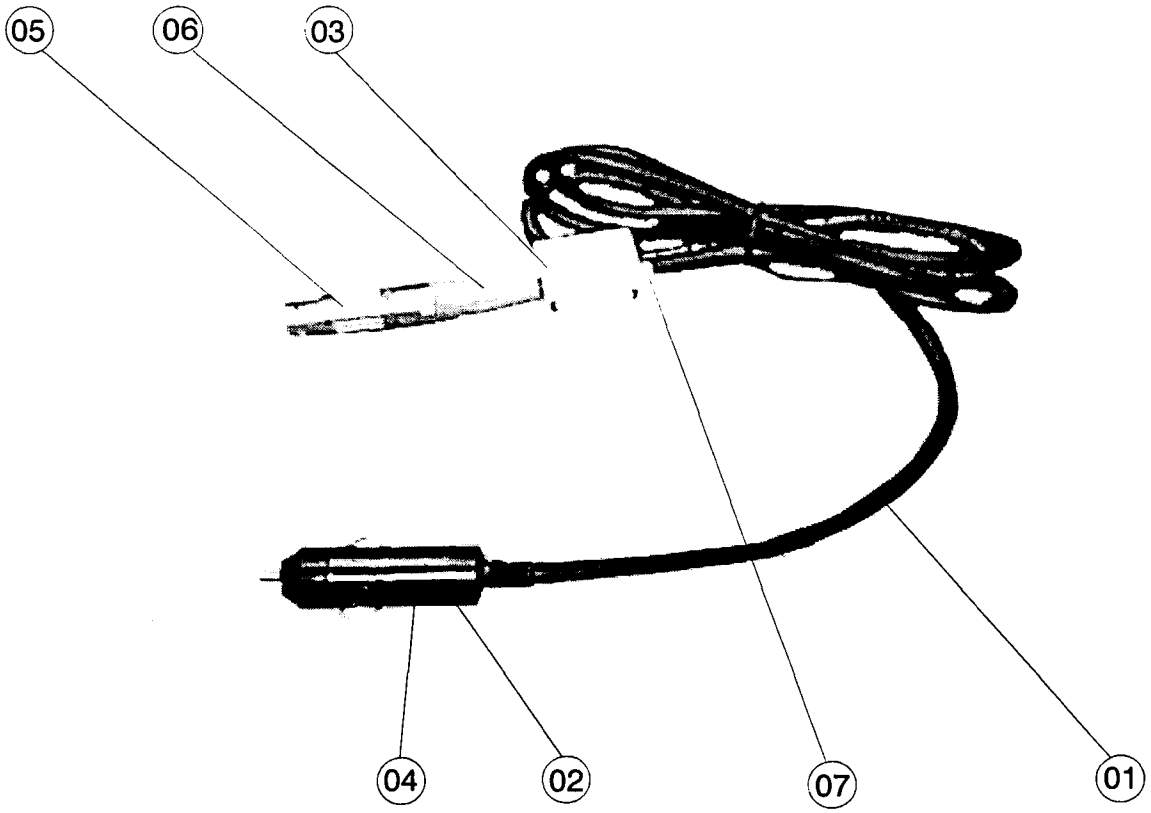


ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	010-0023-00	11	340-0058-00	21	470-0754-31	31	602-0007-00
2	016-0067-00	12	340-0061-00	22	470-0754-41	32	700-0754-17
3	093-0067-06	13	358-0440-08	23	480-0221-00	33	700-0754-18
4	240-0754-07	14	358-0440-11	24	480-0222-00	34	704-0754-06
5	240-0754-08	15	358-0440-17	25	480-0223-00	35	804-0003-00
6	340-0022-00	16	358-0632-04	26	480-0226-00	36	804-0004-00
7	340-0023-00	17	360-0632-09	27	480-0227-00	37	804-0005-00
8	340-0047-00	18	465-0013-00	28	490-0005-00	38	804-0006-00
9	340-0052-00	19	470-0754-11	29	490-0056-00		
10	340-0057-00	20	470-0754-21	30	602-0006-00		

SEE BILL OF MATERIAL 703-0754-01 (PAGE 18 - 24) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 18, FLOW MANIFOLD ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	010-0023-00	CABLE, RIBBON, 6-COND, 10"	N/A
2	2	016-0067-00	TUBING, SHRINK, 3/16" X 3/4" LG	N/A
3	1	093-0067-06	CONNECTOR, PLUG, 6-PIN, IDC	N/A
4	1	240-0754-07	PCB, MANIFOLD INTERFACE, 3-XDCR	N/A
5	1	240-0754-08	PCB, MANIFOLD INTERFACE, 2-XDCR	N/A
6	1	340-0022-00	O-RING, .250 ID X .375 OD X .062 THK	N/A
7	4	340-0023-00	O-RING, .375 ID X .500 OD X .062 THK	N/A
8	5	340-0047-00	O-RING, .312 ID X .437 OD X .062 THK	N/A
9	10	340-0052-00	O-RING, .125 ID X .250 OD X .062 THK	N/A
10	2	340-0057-00	GASKET, SIDE, FLOW MANIFOLD	N/A
11	1	340-0058-00	GASKET, TOP, FLOW MANIFOLD	N/A
12	1	340-0061-00	O-RING, .437 ID X .625 OD X .090 THK	N/A
13	4	358-0440-08	SCREW, PH, PAN HD, 4-40 X 1/2	N/A
14	8	358-0440-11	SCREW, PH, PAN HD, 4-40 X 11/16	N/A
15	8	358-0440-17	SCREW, PH, PAN HD, 4-40 X 1 1/16	N/A
16	4	358-0632-04	SCREW, PH, PAN HD, 6-32 X 1/4	N/A
17	4	360-0632-09	SCREW, CAP, SOCKET HD, 6-32 X 9/16	N/A
18	2	465-0013-00	FILTER, DIFFUSER, 0.490 DIA.	N/A
19	1	470-0754-11	MANIFOLD, FLOW, TOP	N/A
20	1	470-0754-21	MANIFOLD, FLOW, MIDDLE	N/A
21	1	470-0754-31	MANIFOLD, FLOW, LEFT (AIR)	N/A
22	1	470-0754-41	MANIFOLD, FLOW, RIGHT (O2)	N/A
23	1	480-0221-00	DISS O2 W/DEMAND CHECK	N/A
24	1	480-0222-00	DISS AIR W/DEMAND CHECK	N/A
25	1	480-0223-00	GAS OUTLET ADAPTER, 22MM	N/A
26	2	480-0226-00	HOSEBARB, 1/8NPTM X 3/8 ID, 2-BARB	N/A
27	1	480-0227-00	HOSEBARB, 10-32 X 1/8 TUBE, RED	N/A
28	1	490-0005-00	VALVE, LEAF	N/A
29	4	490-0056-00	VALVE, VARIABLE ORIFICE	N/A
30	A/R	602-0006-00	VIBRATITE	N/A
31	A/R	602-0007-00	LOCTITE	N/A
32	1	700-0754-17	JUMPER, 22 AWG, YELLOW, 1 1/2"	N/A
33	1	700-0754-18	JUMPER, 22 AWG, BROWN, 1 1/2"	N/A
34	1	704-0754-06	ASSY, RIBBON CABLE	N/A
35	3	804-0003-00	TRANSDUCER, PRESSURE, 10" DIFF	N/A
36	2	804-0004-00	TRANSDUCER, PRESSURE, 60-PSI	N/A
37	2	804-0005-00	SCREEN, TRANSDUCER, 500M	N/A
38	1	804-0006-00	SCREEN, TRANSDUCER, 400M	N/A

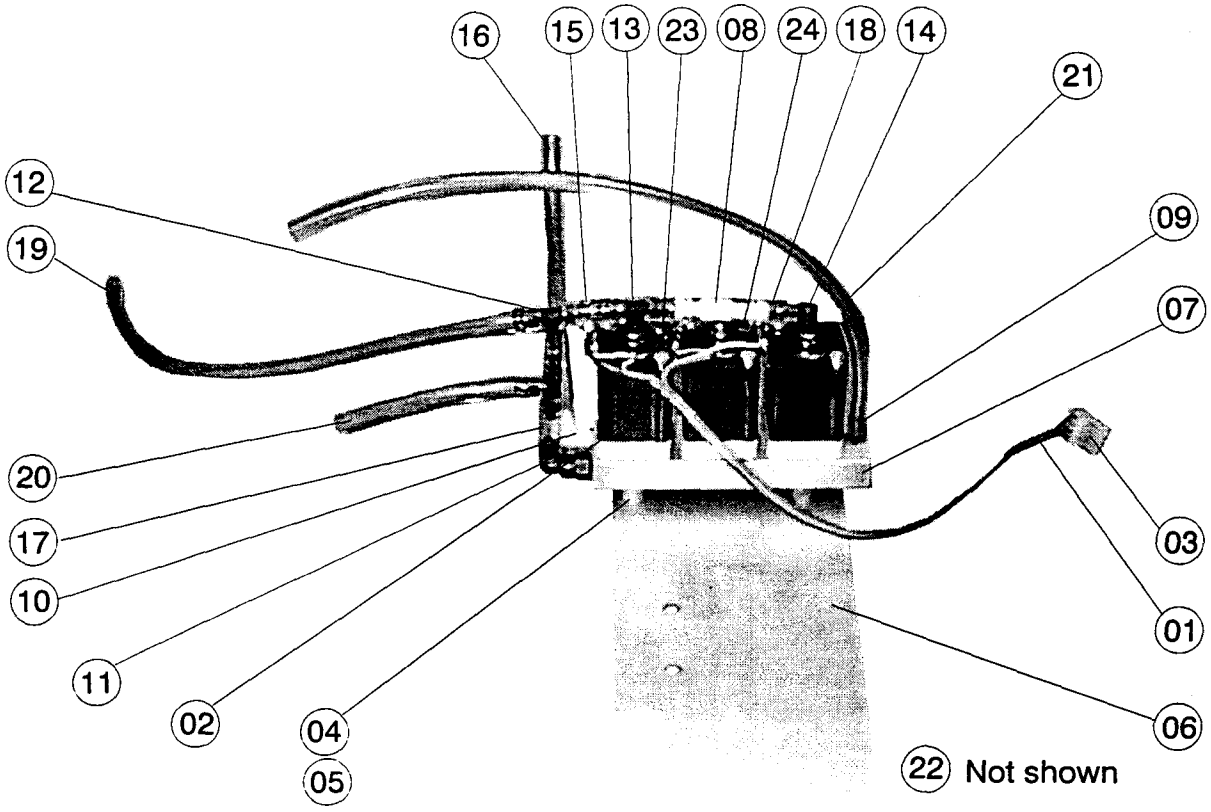


ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	002-0005-00	4	099-0004-02	7	305-0001-00
2	016-0068-00	5	099-0013-06		
3	029-0011-00	6	099-0014-00		

SEE BILL OF MATERIAL 703-075403 (PAGE 18 - 26) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 19, DC POWER CABLE

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	002-0005-00	CABLE, 2-COND, W/SHIELD, 65" LONG	N/A
2	1	016-0068-00	TUBING, SHRINK, 3/8" X 5/8" LG	
3	1	029-0011-00	FERRITE, CLAMP ON	N/A
4	1	099-0004-02	CONNECTOR, AUTO	N/A
5	1	099-0013-06	PLUG, CABLE, POWER/COMM	N/A
6	1	099-0014-00	BEND, RELIEF (USE W/099-0013-06)	N/A
7	1	305-0001-00	CABLE TIE, MINIATURE, 4" LG	N/A



ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	010-0021-00	9	480-0227-00	17	540-0138-00
2	033-0012-00	10	480-0228-00	18	540-0139-00
3	093-0068-04	11	480-0229-00	19	540-0144-00
4	357-0440-08	12	480-0230-00	20	540-0146-00
5	368-0004-00	13	480-0231-00	21	540-0150-00
6	414-0754-11	14	480-0232-00	22	602-0006-00
7	470-0754-51	15	540-0032-00	23	700-0754-09
8	478-0003-00	16	540-0136-00	24	700-0754-10

SEE BILL OF MATERIAL 703-0754-04 (PAGE 18 - 28) FOR COMPLETE PART NUMBER DESCRIPTION

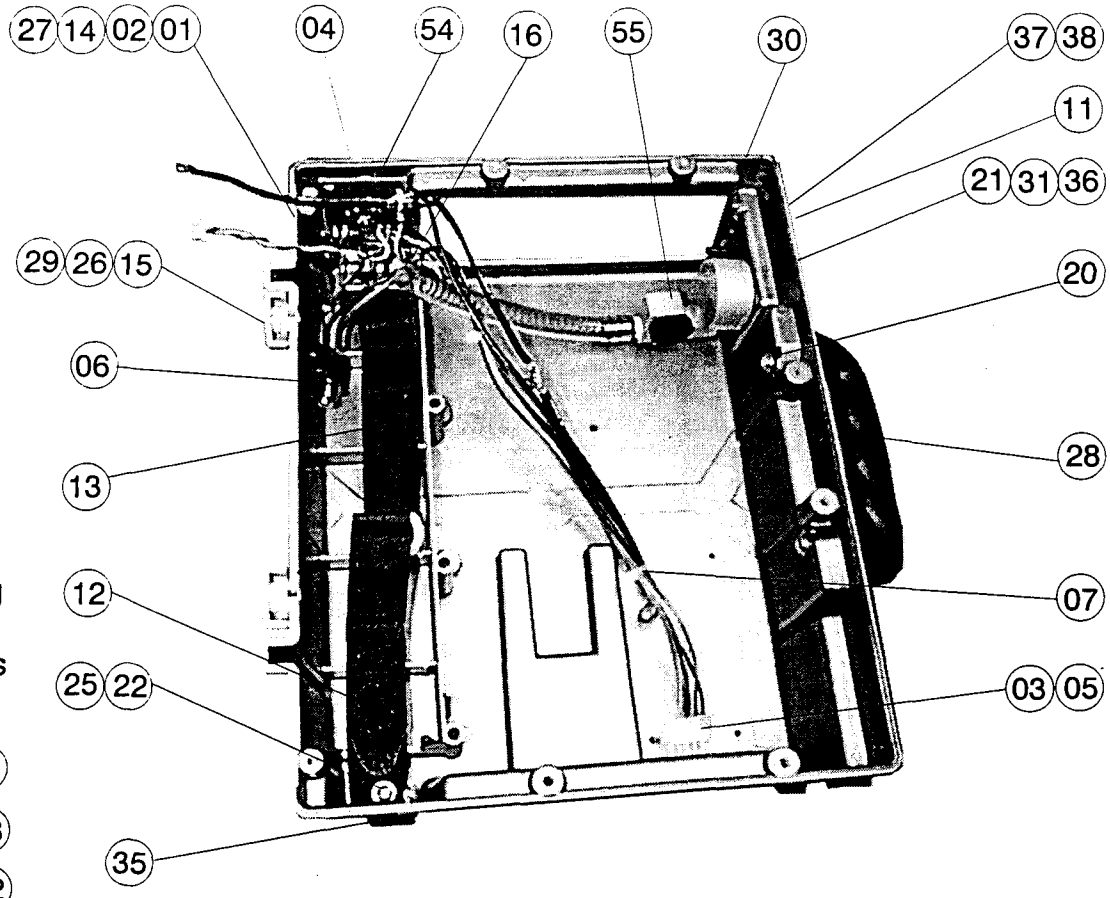
FIGURE 20, EXHAUST MANIFOLD

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	010-0021-00	CABLE, RIBBON, 4-COND, 9"	N/A
2	3	033-0012-00	SLNOID, 9 VDC, HI FL, W/GSKT, SCRWS	N/A
3	1	093-0068-04	CONNECTOR, PLUG, 4-PIN, IDC	N/A
4	4	357-0440-08	SCREW, PH, FLAT HD, 4-40 X 1/2	N/A
5	4	368-0004-00	SPCR, NYL #8, .170 ID X .250 OD X .250 H	N/A
6	1	414-0754-11	CHASSIS, SOLENOID	N/A
7	1	470-0754-51	MANIFOLD, EXHAUST	N/A
8	1	478-0003-00	RESTRICTOR, .030 ID X 1/8 X 1/8 BARB	N/A
9	1	480-0227-00	HOSEBARB, 10-32 X 1/8 TUBE, RED	N/A
10	1	480-0228-00	ELBOW, 10-32 X 1/8 TUBE, WHITE	N/A
11	1	480-0229-00	ELBOW, SWIVL, 10-32 X 1/8 TUBE, BLK	N/A
12	2	480-0230-00	TEE, 1/8 TUBE, BLACK	N/A
13	1	480-0231-00	TEE, BRANCH, 10-32 X 1/8 X 1/8, BLACK	N/A
14	1	480-0232-00	ELBOW, 10-32 X 1/8 TUBE, BLACK	N/A
15	2	540-0032-00	HOSE, TYGON, 1/8 ID X 1/4 OD X 3/4"	N/A
16	1	540-0136-00	HOSE, TYGON, .125 ID X .250 OD X 3 1/2"	N/A
17	1	540-0138-00	HOSE, TYGON, 1/8 ID X 1/4 OD X 1"	N/A
18	2	540-0139-00	HOSE, TYGON, 1/8 ID 1/4 OD X 1/2"	N/A
19	1	540-0144-00	HOSE, TYGON, 1/8 ID X 1/4 OD X 8 1/2"	N/A
20	1	540-0146-00	HOSE, TYGON, 1/8 ID X 1/4 OD X 2 1/4"	N/A
21	1	540-0150-00	HOSE, TYGON, 1/8 ID X 1/4 OD X 8 3/4"	N/A
22	A/R	602-0006-00	VIBRATITE	N/A
23	1	700-0754-09	JUMPER, 22 AWG, RED, 1 3/4"	N/A
24	1	700-0754-10	JUMPER, 22 AWG, RED, 1 3/4"	N/A

Components Mounted to Underside of Case:
09 10 34

Components Mounted to Connector Panel (not shown):
08 17 18 19
32 33 39 40

Interconnecting Components & Sub-Assemblies (not shown):
23 24 41 42
45 46 47 48
49 50 51 52
53 56



Not shown
43 44

ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	016-0004-00	15	338-0007-00	29	392-0750-11	43	602-0005-00
2	081-0019-00	16	346-0632-01	30	416-0754-11	44	602-0006-00
3	089-0022-00	17	346-1420-00	31	420-0754-11	45	602-0007-00
4	089-0024-00	18	346-3416-00	32	422-0754-21	46	700-0754-03
5	092-0008-00	19	346-9618-02	33	422-0754-41	47	700-0754-04
6	099-0010-02	20	357-0632-06	34	450-0008-00	48	700-0754-05
7	305-0001-00	21	358-0440-08	35	450-0010-00	49	700-0754-06
8	312-0062-00	22	358-0632-06	36	465-0012-00	50	700-0754-07
9	325-0754-01	23	358-0632-08	37	480-0235-00	51	700-0754-08
10	325-0754-02	24	370-0009-00	38	480-0236-00	52	703-0754-01
11	325-0754-07	25	376-0007-00	39	480-0238-00	53	703-0754-04
12	334-0053-00	26	376-0008-00	40	480-0239-00	54	704-0754-03
13	334-0054-00	27	376-0062-00	41	540-0141-00	55	704-0754-04
14	334-0063-00	28	390-0002-00	42	540-0144-00	56	704-0754-05

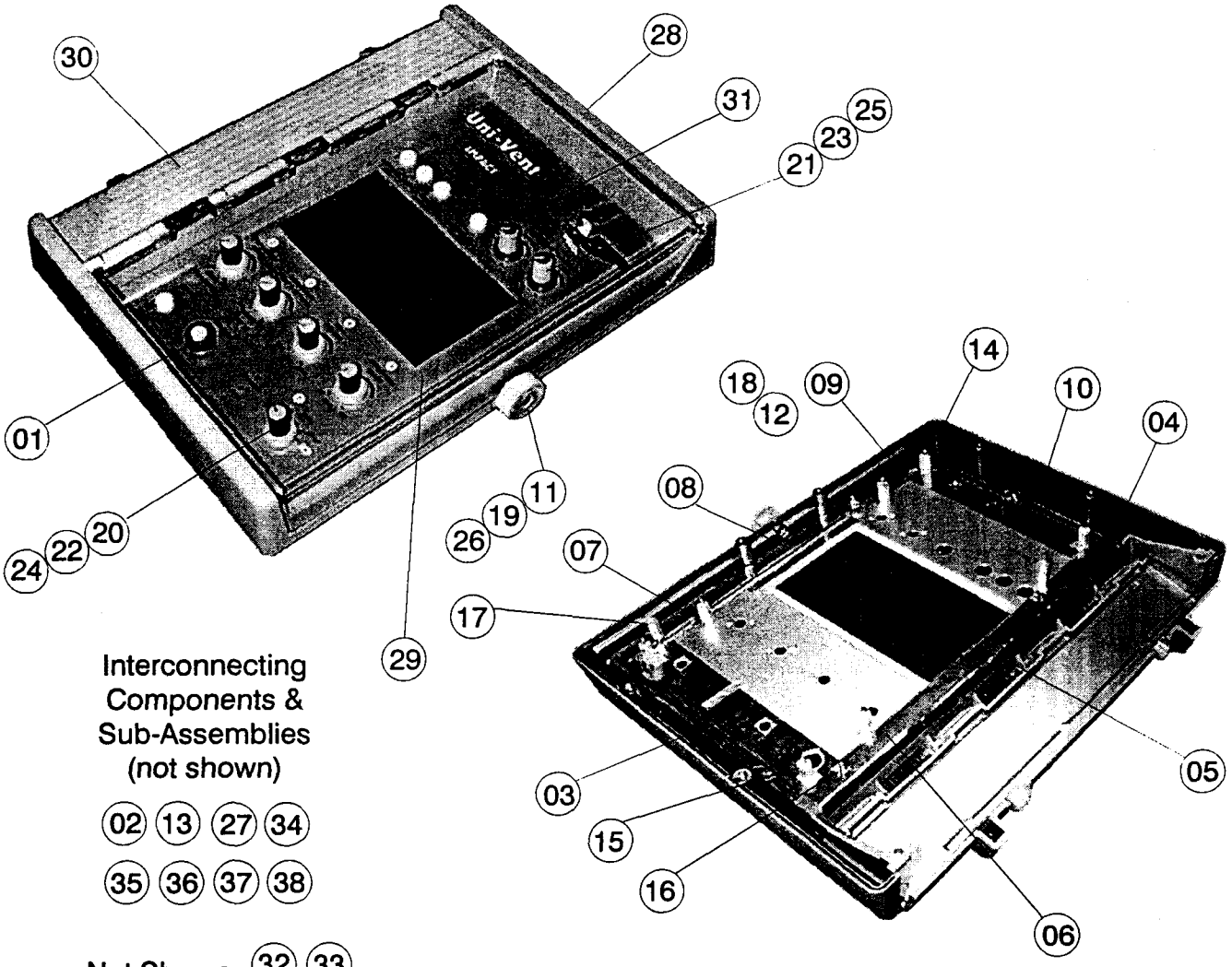
SEE BILL OF MATERIAL 703-0754-05 (PAGE 18 - 30 & 18 - 31) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 21, LOWER CASE ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	5	016-0004-00	TUBING, SHRINK, 3/16" X 1" LG	N/A
2	2	081-0019-00	FUSE, 10A, 2AG	F1,2
3	1	089-0022-00	CONNECTOR, POWER/COMM, 6-PIN	N/A
4	1	089-0024-00	COVER, SNAP (USE WITH 089-0022-00)	N/A
5	5	092-0008-00	PIN, FEMALE (USE W/093-0060-08)	N/A
6	1	099-0010-02	CONNECTOR, PLUG, 2-CONDUCTOR	N/A
7	7	305-0001-00	CABLE TIE, MINIATURE, 4" LG	N/A
8	1	312-0062-00	TAPE, NEO, P/S, BLK, 1/8" W X 5 3/8" LG	N/A
9	1	325-0754-01	LABEL, CONDENSED OPR INSTR	N/A
10	1	325-0754-02	LABEL, S/N, COMMERCIAL	N/A
11	1	325-0754-07	LABEL, CAUTION	N/A
12	1	334-0053-00	STRAP, VELCRO, LOOP W/D-RING	N/A
13	1	334-0054-00	STRAP, VELCRO, LOOP/HOOK	N/A
14	2	334-0063-00	FUSEHOLDER	N/A
15	2	338-0007-00	RIVET	N/A
16	2	346-0632-01	NUT, KEPS, 6-32	N/A
17	2	346-1420-00	NUT, HEX, 1/4-20	N/A
18	1	346-3416-00	NUT, 3/4-16 UNF-2B X .125 THK	N/A
19	1	346-9618-02	NUT, 9/16-18, UNF-2B X .625 THK	N/A
20	1	357-0632-06	SCREW, PH, FLAT HD, 6-32 X 3/8	N/A
21	3	358-0440-08	SCREW, PH, PAN HD, 4-40 X 1/2	N/A
22	3	358-0632-06	SCREW, PH, PAN HD, 6-32 X 3/8	N/A
23	3	358-0632-08	SCREW, PH, PAN HD, 6-32 X 1/2	N/A
24	1	370-0009-00	SPRING, .360 OD X 3 1/4" LG	N/A
25	6	376-0007-00	WASHER, FLAT, #6	N/A
26	2	376-0008-00	WASHER, FLAT, #4	N/A
27	2	376-0062-00	WASHER, LOCK, INT TOOTH, .5 ID X .6 OD X .03 THK	N/A
28	1	390-0002-00	HANDLE (WITH MOUNTING FLANGES)	N/A
29	2	392-0750-11	KNOB, DOOR	N/A
30	1	416-0754-11	COVER, BOTTOM, MODIFIED	N/A
31	1	420-0754-11	HOUSING, COMP, AIR INLET, 22MM	N/A
32	1	422-0754-21	PANEL, CONNECTOR	N/A
33	1	422-0754-41	PANEL, CONNECTOR, SUB	N/A
34	4	450-0008-00	BUMPER, RUBBER, FOOT, .50 X .12, BLK	N/A
35	4	450-0010-00	BUMPER, RUBBER, FOOT, .44 X .20, BLK	N/A
36	1	465-0012-00	FILTER, COMPRESSOR, AIR INLET	N/A
37	1	480-0235-00	HOSEBARB, 1/4-28 X 1/8 TUBE, BLK	N/A
38	1	480-0236-00	NUT, LOCK, PLASTIC, 1/4-28, BLK	N/A
39	1	480-0238-00	HOSEBARB, BULKHEAD, .285 DIA, GRN	N/A
40	1	480-0239-00	HOSEBARB, BULKHEAD, .355 DIA, CLR	N/A
41	1	540-0141-00	HOSE, PVC, 3/8 ID X 1/2 OD X 4"	N/A
42	1	540-0144-00	HOSE, TYGON, 1/8 ID X 1/4 OD X 8 1/2"	N/A
43	A/R	602-0005-00	SEALANT, SILICONE RUBBER, RTV	N/A
44	A/R	602-0006-00	VIBRATITE	N/A
45	A/R	602-0007-00	LOCTITE	N/A
46	1	700-0754-03	JUMPER, 18 AWG, GREEN, 12"	N/A
47	1	700-0754-04	JUMPER, 18 AWG, YELLOW, 12"	N/A

BILL OF MATERIAL:
703-0754-05
LOWER CASE ASSEMBLY

48	1	700-0754-05	JUMPER, 18 AWG, BLUE, 12"	N/A
49	1	700-0754-06	JUMPER, 18 AWG, BLUE, 3"	N/A
50	1	700-0754-07	JUMPER, 18 AWG, ORANGE, 12"	N/A
51	1	700-0754-08	JUMPER, 18 AWG, BROWN, 10"	N/A
52	1	703-0754-01	ASSY, FLOW MANIFOLD	N/A
53	1	703-0754-04	ASSY, EXHAUST MANIFOLD	N/A
54	1	704-0754-03	ASSY, PCB, FILTER	N/A
55	1	704-0754-04	ASSY, COMPRESSOR AIR INLET	N/A
56	1	704-0754-05	ASSY, COMPRESSOR	N/A



Interconnecting Components & Sub-Assemblies (not shown)

02 13 27 34

35 36 37 38

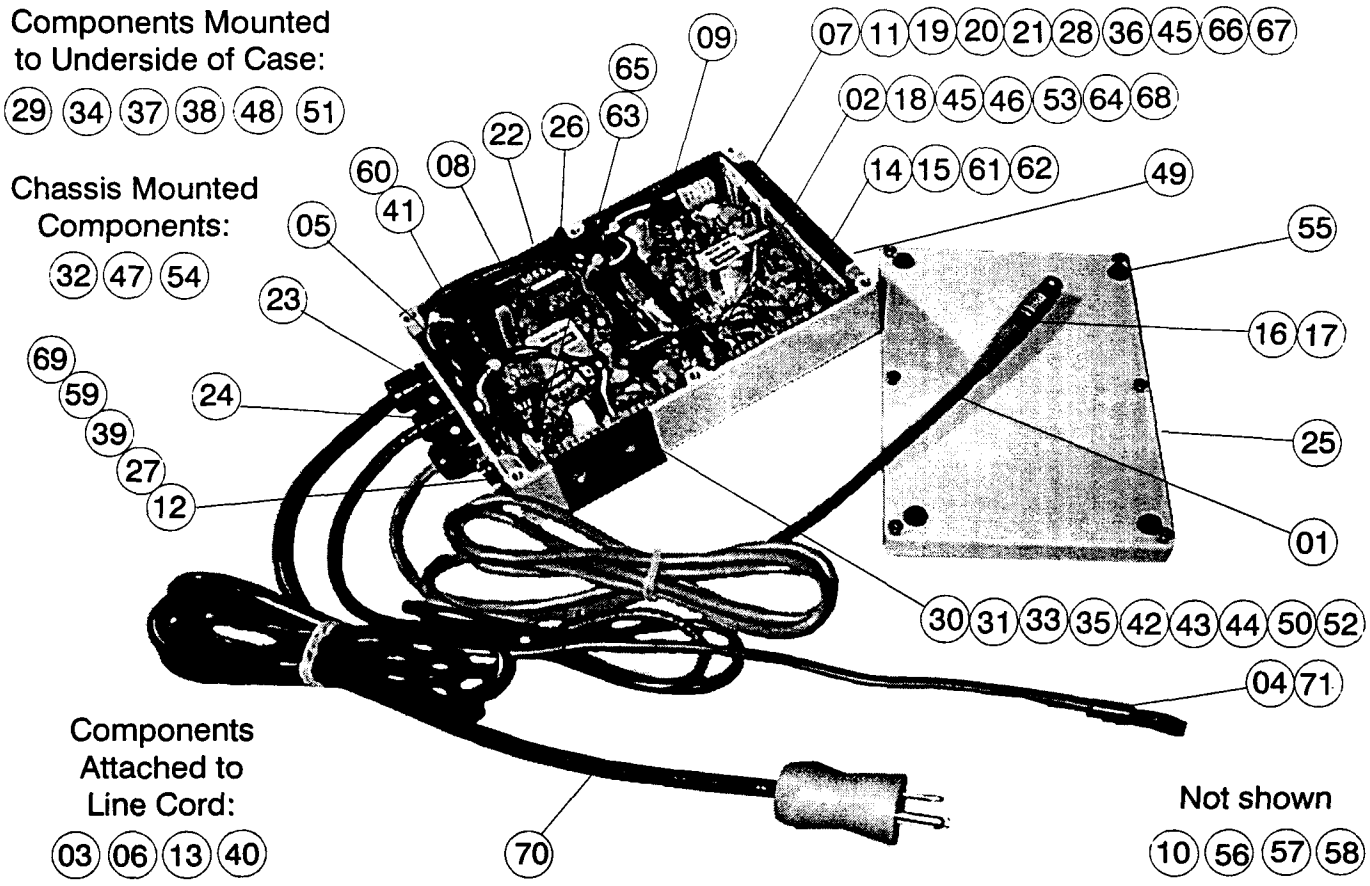
Not Shown 32 33

ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	133-0001-00	11	338-0007-00	21	392-0025-00	31	422-0754-11
2	312-0079-00	12	346-0440-01	22	392-0027-00	32	602-0007-00
3	312-0085-00	13	358-0440-04	23	392-0028-00	33	606-0002-00
4	312-0086-00	14	368-0028-00	24	392-0030-00	34	702-0754-01
5	312-0087-00	15	368-0029-00	25	392-0031-00	35	702-0754-02
6	312-0088-00	16	368-0030-00	26	392-0750-11	36	702-0754-03
7	312-0089-00	17	368-0034-00	27	404-0754-11	37	702-0754-04
8	312-0090-00	18	376-0007-00	28	416-0754-21	38	702-0754-05
9	312-0091-00	19	376-0008-00	29	418-0750-41		
10	312-0092-00	20	392-0024-00	30	418-0754-11		

SEE BILL OF MATERIAL 703-0754-06 (PAGE 18 - 33) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 22, UPPER CASE ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	133-0001-00	GUARD, SWITCH, BLACK	N/A
2	1	312-0079-00	TAPE, FOAM, WHITE, P/S, 5 1/4"LG	N/A
3	1	312-0085-00	TAPE, COPPER, 2" W X 5 1/2" LG	N/A
4	1	312-0086-00	TAPE, COPPER, 1" W X 3 1/4" LG	N/A
5	1	312-0087-00	TAPE, COPPER, 1" W X 3 1/4" LG	N/A
6	1	312-0088-00	TAPE, COPPER, 1" W X 3 1/4" LG	N/A
7	1	312-0089-00	TAPE, COPPER, 1" W X 3 3/8" LG	N/A
8	1	312-0090-00	TAPE, COPPER, 1" W X 3 3/8" LG	N/A
9	1	312-0091-00	TAPE, COPPER, 1" W X 3 1/8" LG	N/A
10	1	312-0092-00	TAPE, COPPER, 2" W X 5 1/2" LG	N/A
11	1	338-0007-00	RIVET	N/A
12	10	346-0440-01	NUT, KEPS, 4-40	N/A
13	1	358-0440-04	SCREW, PH, PAN HD, 4-40 X 1/4	N/A
14	15	368-0028-00	SPACER, THREADED, M/F, 4-40 X 1/2	N/A
15	9	368-0029-00	SPACER, THREADED, M/F, 4-40 X 3/8	N/A
16	1	368-0030-00	SPACER, THREADED, F/F, 4-40 X 3/8	N/A
17	2	368-0034-00	SPACER, THREADED, F/F, 4-40 X 1/2	N/A
18	3	376-0007-00	WASHER, FLAT, #6	N/A
19	1	376-0008-00	WASHER, FLAT, #4	N/A
20	5	392-0024-00	KNOB, BLACK	N/A
21	2	392-0025-00	KNOB, GRAY	N/A
22	5	392-0027-00	CAP, KNOB, GRAY	N/A
23	2	392-0028-00	CAP, KNOB, RED	N/A
24	5	392-0030-00	SKIRT, KNOB, GRAY	N/A
25	2	392-0031-00	SKIRT, KNOB, RED	N/A
26	1	392-0750-11	KNOB, DOOR	N/A
27	1	404-0754-11	BKT, BATTERY COMPARTMENT DIVIDER	N/A
28	1	416-0754-21	COVER, TOP	N/A
29	1	418-0750-41	DOOR, BATTERY COMPARTMENT	N/A
30	1	418-0754-11	DOOR, TOP COVER	N/A
31	1	422-0754-11	FRONT PANEL	N/A
32	A/R	602-0007-00	LOCTITE	N/A
33	A/R	606-0002-00	KRYTOX	N/A
34	1	702-0754-01	ASSY, PCB, SWITCH PANEL	N/A
35	1	702-0754-02	ASSY, PCB, ANALOG	N/A
36	1	702-0754-03	ASSY, PCB, CPU	N/A
37	1	702-0754-04	ASSY, PCB, POWER SUPPLY	N/A
38	1	702-0754-05	ASSY, PCB, MOTOR DRIVER	N/A



ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	006-2013-02	19	305-0001-00	37	358-1032-06	55	450-0008-00
2	016-0004-00	20	310-0002-00	38	358-1032-08	56	602-0005-00
3	016-0010-00	21	312-0094-00	39	368-0026-00	57	602-0006-00
4	016-0069-00	22	325-0754-08	40	374-0017-00	58	602-0007-00
5	016-0070-00	23	340-0030-00	41	374-0020-00	59	700-0754-47
6	016-0071-00	24	340-0048-00	42	376-0003-00	60	700-0754-48
7	016-0072-00	25	340-0066-00	43	376-0007-00	61	700-0754-49
8	024-0002-00	26	340-0080-00	44	376-0008-00	62	700-0754-50
9	026-0004-00	27	344-0002-00	45	376-0061-00	63	700-0754-51
10	029-0011-00	28	346-0440-01	46	378-0440-05	64	700-0754-52
11	047-1045-00	29	346-0632-01	47	378-0440-08	65	700-0754-53
12	089-0023-00	30	346-1032-01	48	390-0004-00	66	700-0754-54
13	093-0078-05	31	357-0440-05	49	402-0754-04	67	700-0754-55
14	093-0080-06	32	357-0440-07	50	404-0021-11	68	700-0754-56
15	093-0081-04	33	357-0632-03	51	404-0306-91	69	700-0754-57
16	099-0013-06	34	357-0632-06	52	404-0754-51	70	708-0006-00
17	099-0014-00	35	358-0440-05	53	404-0754-61	71	708-0750-01
18	210-0400-02	36	358-0440-06	54	414-0754-41		

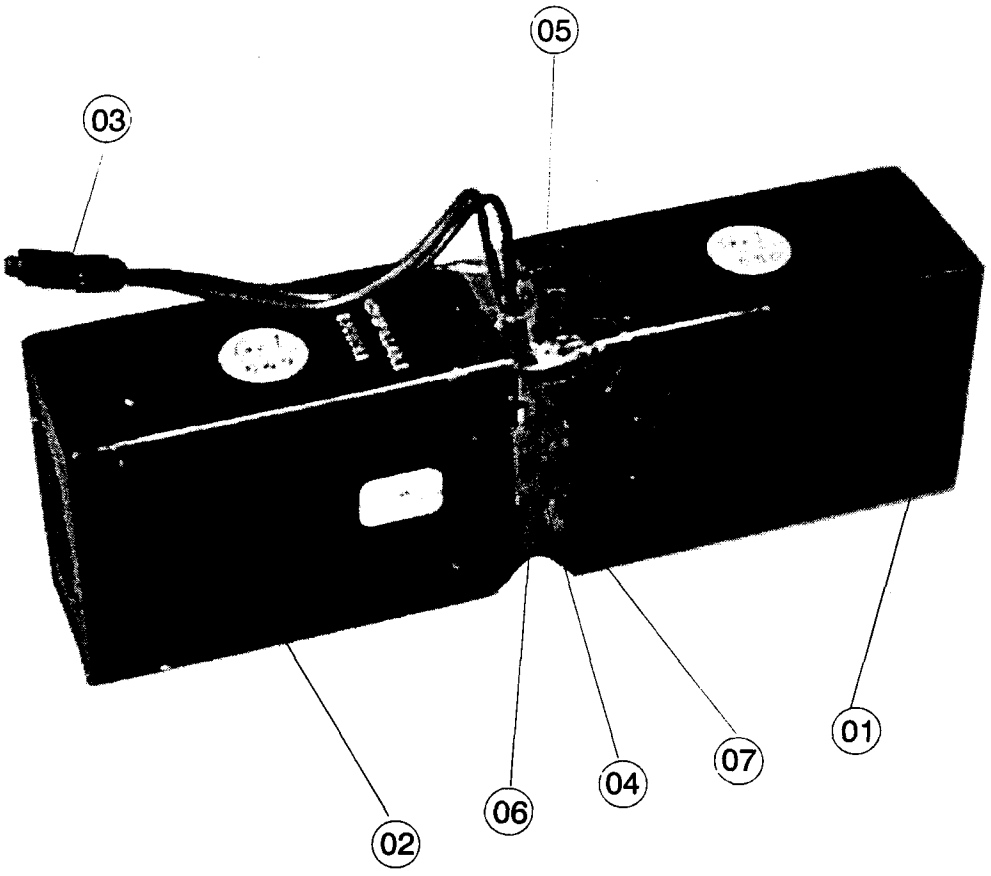
SEE BILL OF MATERIAL 703-0754-09 (PAGE 18 - 35 & 18 - 36) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 23, POWER SUPPLY (OPTIONAL)

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	006-2013-02	CABLE, 77" LG	N/A
2	3	016-0004-00	TUBING, SHRINK, 3/16" X 1" LG	N/A
3	3	016-0010-00	TUBING, SHRINK, 3/8" X 1" LG	N/A
4	1	016-0069-00	TUBING, SHRINK, 3/8" X 2" LG	N/A
5	1	016-0070-00	TUBING, SHRINK, 1/8" X 3 3/4" LG	N/A
6	1	016-0071-00	TUBING, SHRINK, 3/16" X 7 3/4" LG	N/A
7	4	016-0072-00	TUBING, SHRINK, 1/8" X 3/4" LG	N/A
8	1	024-0002-00	ASSY, PCB, UNIV AC PWR SUPPLY	N/A
9	1	026-0004-00	DC-DC CONVERTER MODULE	N/A
10	1	029-0011-00	FERRITE, CLAMP ON	L2
11	2	047-1045-00	DIODE, SCHOTTKEY, 10A, 45V, MBR1045	N/A
12	1	089-0023-00	CONNECTOR, RS-232C, 9-PIN FEM, SUB-D	N/A
13	2	093-0078-05	CONNECTOR, PLUG, 5-PIN	N/A
14	2	093-0080-06	CONNECTOR, PLUG, 6-PIN	N/A
15	4	093-0081-04	CONNECTOR, PLUG, 4-PIN	N/A
16	1	099-0013-06	PLUG, CABLE, POWER/COMM	N/A
17	1	099-0014-00	BEND, RELIEF (USE W/099-0013-06)	N/A
18	1	210-0400-02	RES, POWER, WW, 40 OHM, 10W, 1%	N/A
19	7	305-0001-00	CABLE TIE, MINIATURE, 4" LG	N/A
20	2	310-0002-00	INSULATOR, MICA, TO-220	N/A
21	1	312-0094-00	TAPE, FOAM, WHITE, P/S, 1/2" LG	N/A
22	1	325-0754-08	LABEL, S/N, UNIV AC PWR SPLY/CNVTR	N/A
23	2	340-0030-00	BUSHING, STRAIN RELIEF, LG, W/NUT	N/A
24	1	340-0048-00	BUSHING, STRAIN RELIEF, LG, W/NUT	N/A
25	1	340-0066-00	GASKT, EMI, .09 OD X .05 ID X 27" LG	N/A
26	3	340-0080-00	GASKET, U-CHANNEL, 4 1/2" LG	N/A
27	1	344-0002-00	LUG, SOLDER, #4	N/A
28	12	346-0440-01	NUT, KEPS, 4-40	N/A
29	2	346-0632-01	NUT, KEPS, 6-32	N/A
30	2	346-1032-01	NUT, KEPS, 10-32	N/A
31	4	357-0440-05	SCREW, PH, FLAT HD, 4-40 X 5/16	N/A
32	2	357-0440-07	SCREW, PH, FLAT HD, 4-40 X 7/16	N/A
33	8	357-0632-03	SCREW, PH, FLAT HD, 6-32 X 3/16	N/A
34	2	357-0632-06	SCREW, PH, FLAT HD, 6-32 X 3/8	N/A
35	3	358-0440-05	SCREW, PH, PAN HD, 4-40 X 5/16	N/A
36	2	358-0440-06	SCREW, PH, PAN HD, 4-40 X 3/8	N/A
37	2	358-1032-06	SCREW, PH, PAN HD, 10-32 X 3/8	N/A
38	2	358-1032-08	SCREW, PH, PAN HD, 10-32 X 1/2	N/A
39	2	368-0026-00	SPACER, M/F, 4-40 (USE W/089-0023-00)	N/A
40	2	374-0017-00	TERMINAL, INSULATED, RING, #6, BLUE	N/A
41	2	374-0020-00	TERMINAL, INSULATED, RING, #6, RED	N/A
42	2	376-0003-00	WASHER, FLAT, #10	N/A
43	8	376-0007-00	WASHER, FLAT, #6	N/A
44	1	376-0008-00	WASHER, FLAT, #4	N/A
45	2	376-0061-00	WSHR, SHLDR, NYL, #4, .145 BRL X .125L	N/A
46	1	378-0440-05	STANDOFF, SELF-CLINCHING, 4-40 X 5/16	N/A
47	1	378-0440-08	STANDOFF, SELF-CLINCHING, 4-40 X 1/2	N/A

BILL OF MATERIAL:
703-0754-09
POWER SUPPLY, OPTIONAL

48	1	390-0004-00	HANDLE	N/A
49	1	402-0754-04	CASE, UNIVERSAL AC PWR SUPPLY	N/A
50	1	404-0021-11	BRACKET, MOUNTING (DOVETAIL)	N/A
51	1	404-0306-91	BRACKET, SS	N/A
52	1	404-0754-51	BRACKET, SUPPORT (DOVETAIL)	N/A
53	1	404-0754-61	BRACKET, MOUNTING, POWER RESISTOR	N/A
54	1	414-0754-41	CHASSIS	N/A
55	8	450-0008-00	BUMPER, RUBBER, FOOT, .50 X .12, BLK	N/A
56	A/R	602-0005-00	SEALANT, SILICONE RUBBER, RTV	N/A
57	A/R	602-0006-00	VIBRATITE	N/A
58	A/R	602-0007-00	LOCTITE	N/A
59	1	700-0754-47	JUMPER, 22 AWG, BLACK, 5"	N/A
60	1	700-0754-48	JUMPER, 18 AWG, BLACK, 8"	N/A
61	1	700-0754-49	JUMPER, 18 AWG, RED, 6"	N/A
62	1	700-0754-50	JUMPER, 18 AWG, BLACK, 6"	N/A
63	1	700-0754-51	JUMPER, 18 AWG, RED, 3 3/4"	N/A
64	1	700-0754-52	JUMPER, 18 AWG, RED, 4 3/4"	N/A
65	1	700-0754-53	JUMPER, 18 AWG, ORANGE, 5 1/2"	N/A
66	1	700-0754-54	JUMPER, 18 AWG, ORANGE, 3 1/4"	N/A
67	1	700-0754-55	JUMPER, 18 AWG, RED, 5"	N/A
68	1	700-0754-56	JUMPER, 18 AWG, BLACK, 4 1/2"	N/A
69	1	700-0754-57	JUMPER, 18 AWG, BLACK, 7 1/2"	N/A
70	1	708-0006-00	LINE CORD	N/A
71	1	708-0750-01	CABLE, 2-COND, W/SHIELD	N/A

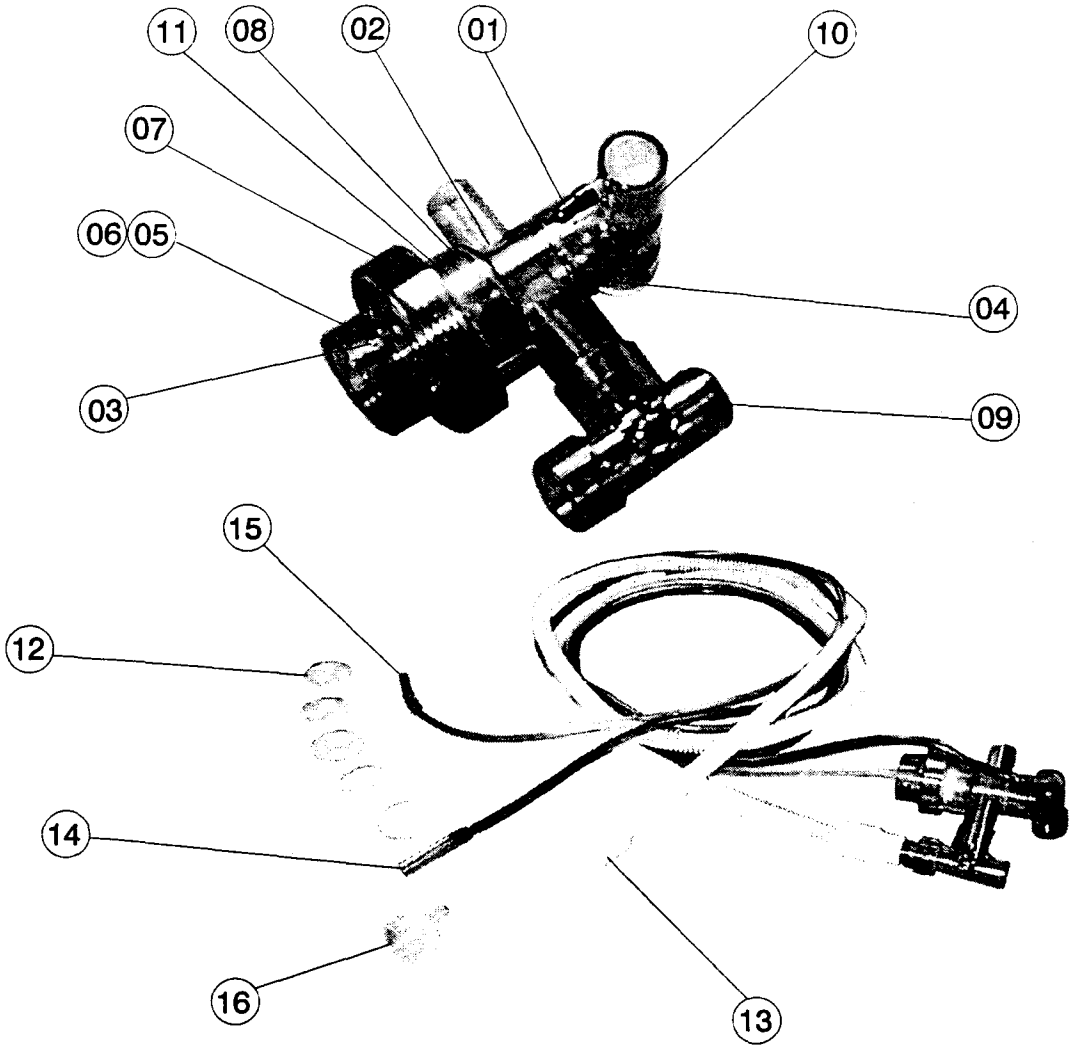


ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	016-0029-00	4	310-0016-00	7	700-0754-46
2	021-0019-00	5	581-0018-00		
3	099-0009-02	6	600-0003-00		

SEE BILL OF MATERIAL 704-0754-01 (PAGE 18 - 36) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 24, BATTERY PACK ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	016-0029-00	TUBING, SHRINK, 123mm FLAT X 9 3/4" LG	N/A
2	2	021-0019-00	BATTERY, LEAD ACID, 6VDC, 5AH	B1/B2
3	1	099-0009-02	CONNECTOR, PLUG, 2-CONDUCTOR	N/A
4	1	310-0016-00	INSULATOR, BATTERY, 5AH	N/A
5	A/R	581-0018-00	TAPE, MYLAR, CLEAR, 2" W	N/A
6	A/R	600-0003-00	GLUE, HOT MELT	N/A
7	1	700-0754-46	JUMPER, 18 AWG, ORANGE, 3"	N/A



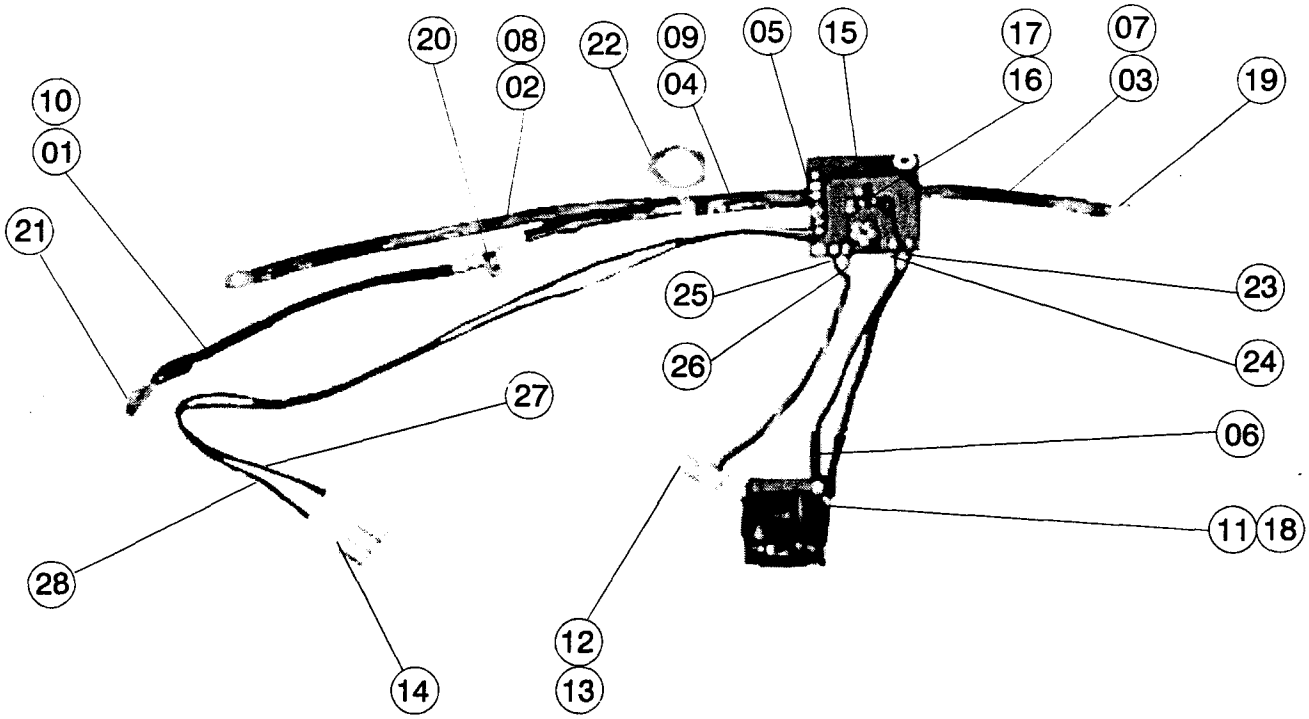
ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	480-0252-00	7	490-0024-00	13	540-0076-00
2	490-0005-00	8	490-0025-00	14	540-0154-00
3	490-0020-00	9	490-0027-00	15	540-0155-00
4	490-0021-00	10	490-0059-00	16	820-0034-00
5	490-0022-00	11	490-0061-00		
6	490-0023-00	12	334-0032-00		

SEE BILL OF MATERIAL 704-0754-02 (PAGE 18 - 40) FOR COMPLETE PART NUMBER DESCRIPTION

NOTE: ITEMS 12 THRU 16 ARE NOT PART OF THIS ASSEMBLY BUT ARE NECESSARY TO CONNECT PATIENT VALVE ASSEMBLY TO VENTILATOR.

FIGURE 25, REUSABLE PATIENT VALVE ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	480-0252-00	HOSEBARB, 10-32 X 1/8" TUBE, GREEN	N/A
2	1	490-0005-00	VALVE, LEAF	N/A
3	1	490-0020-00	VALVE, HOUSING	N/A
4	1	490-0021-00	EXHALATION CAP, OUTER	N/A
5	1	490-0022-00	EXHALATION CAP, INNER	N/A
6	1	490-0023-00	COLLAR, THREADED	N/A
7	1	490-0024-00	CROSS HAIR	N/A
8	1	490-0025-00	ELBOW, GAS INLET	N/A
9	1	490-0027-00	REDUCER, 15MM MALE TO 10MM MALE	N/A
10	1	490-0059-00	VALVE, DIAPHRAGM	N/A
11	1	490-0061-00	ELBOW, PATIENT CONNECTION	N/A

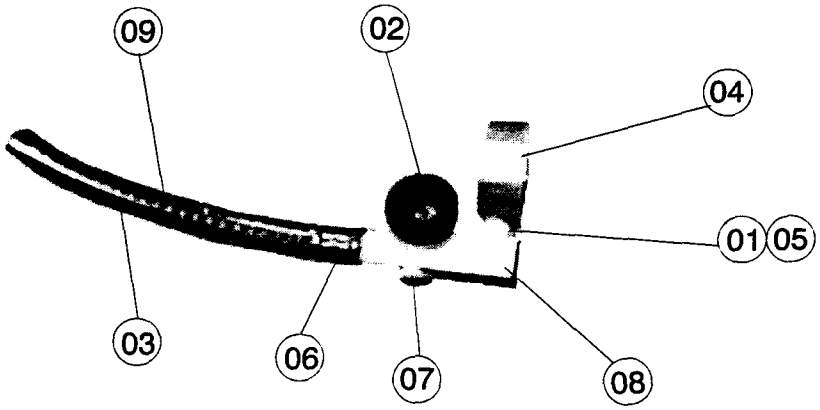


ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	011-0002-00	11	029-0013-00	21	344-0004-00
2	011-0003-00	12	092-0008-00	22	344-0005-00
3	011-0004-00	13	093-0060-08	23	700-0754-11
4	011-0005-00	14	093-0062-03	24	700-0754-12
5	012-0009-00	15	240-0754-09	25	700-0754-13
6	016-0034-00	16	255-1056-31	26	700-0754-14
7	016-0063-00	17	259-1044-51	27	700-0754-15
8	016-0064-00	18	312-0078-00	28	700-0754-16
9	016-0065-00	19	344-0001-00		
10	016-0066-00	20	344-0002-00		

SEE BILL OF MATERIAL 704-0754-03 (PAGE 18 - 42) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 26, FILTER PCB ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	011-0002-00	BRAID, GND, 1/4" X 9"	N/A
2	1	011-0003-00	BRAID, GND, 1/4" X 8"	N/A
3	1	011-0004-00	BRAID, GND, 1/4" X 4"	N/A
4	1	011-0005-00	BRAID, GND, 1/4" X 2"	N/A
5	1	012-0009-00	BUSSWIRE, 18 AWG, 1" LG	N/A
6	2	016-0034-00	TUBING, SHRINK, 1/8" X 1" LG	N/A
7	1	016-0063-00	TUBING, SHRINK, 1/4" X 3 1/2" LG	N/A
8	1	016-0064-00	TUBING, SHRINK, 1/4" X 7 3/4" LG	N/A
9	1	016-0065-00	TUBING, SHRINK, 1/4" X 1 3/4" LG	N/A
10	2	016-0066-00	TUBING, SHRINK, 1/4" X 4 1/4" LG	N/A
11	1	029-0013-00	INDUCTOR, 1mH	N/A
12	2	092-0008-00	PIN, FEMALE (USE W/093-0060-08)	N/A
13	1	093-0060-08	CONNECTOR, HOUSING, 8-PIN	N/A
14	1	093-0062-03	CONNECTOR, PLUG, 3-PIN, IDC	N/A
15	1	240-0754-09	PCB, 2-LAYER, FILTER	N/A
16	1	255-1056-31	CAP, TANTALUM, 1.0UFD, 35V	C2
17	2	259-1044-51	CAP, METAL FILM, 0.1UF, 5%, 50V	C1,3
18	2	312-0078-00	TAPE, ELECTRICAL, 3/4" W X 4" LG	N/A
19	2	344-0001-00	LUG, SOLDER, #6	N/A
20	1	344-0002-00	LUG, SOLDER, #4	N/A
21	1	344-0004-00	LUG, SOLDER, 1/4"	N/A
22	1	344-0005-00	LUG, SOLDER (USE W/089-0022-00)	N/A
23	1	700-0754-11	JUMPER, 18 AWG, RED, 4 1/2"	N/A
24	1	700-0754-12	JUMPER, 18 AWG, RED, 4 1/2"	N/A
25	1	700-0754-13	JUMPER, 22 AWG, RED, 5"	N/A
26	1	700-0754-14	JUMPER, 22 AWG, ORANGE, 5"	N/A
27	1	700-0754-15	JUMPER, 18 AWG, BLACK, 12"	N/A
28	1	700-0754-16	JUMPER, 18 AWG, BLACK, 12"	N/A



ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	312-0021-00	4	420-0754-21	7	480-0233-00
2	340-0019-00	5	480-0132-00	8	480-0234-00
3	370-0008-00	6	480-0226-00	9	540-0020-00

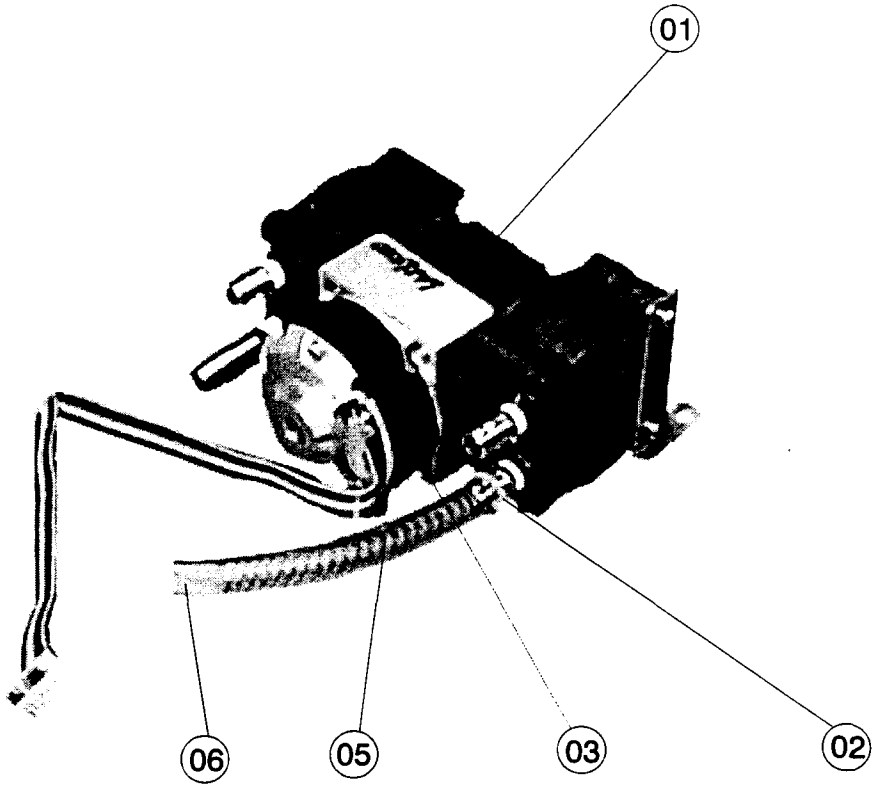
SEE BILL OF MATERIAL 704-0754-04 (PAGE 18 - 44) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 27, COMPRESSOR AIR INLET ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	A/R	312-0021-00	TAPE, TEFLON, 1/2" WIDE	N/A
2	1	340-0019-00	BUSHING, 3/8 ID, 21/32 SHLDR, 7/8 OD	N/A
3	1	370-0008-00	SPRING, .360 OD X 4 1/4" LG	N/A
4	1	420-0754-21	HOUSING, COMP, AIR INLET, FILTER	N/A
5	1	480-0132-00	NIPPLE, CLOSE, 1/2", CHROME	N/A
6	1	480-0226-00	HOSEBARB, 1/8NPTM X 3/8 ID, 2-BARB	N/A
7	1	480-0233-00	PLUG, 1/8NPTM, BRASS, W/HEX	N/A
8	1	480-0234-00	ADAPTER, PUMP INLET	N/A
9	1	540-0020-00	HOSE, PVC, 3/8 ID X 1/2 OD X 5"	N/A

04 Not Shown

07 Not Shown

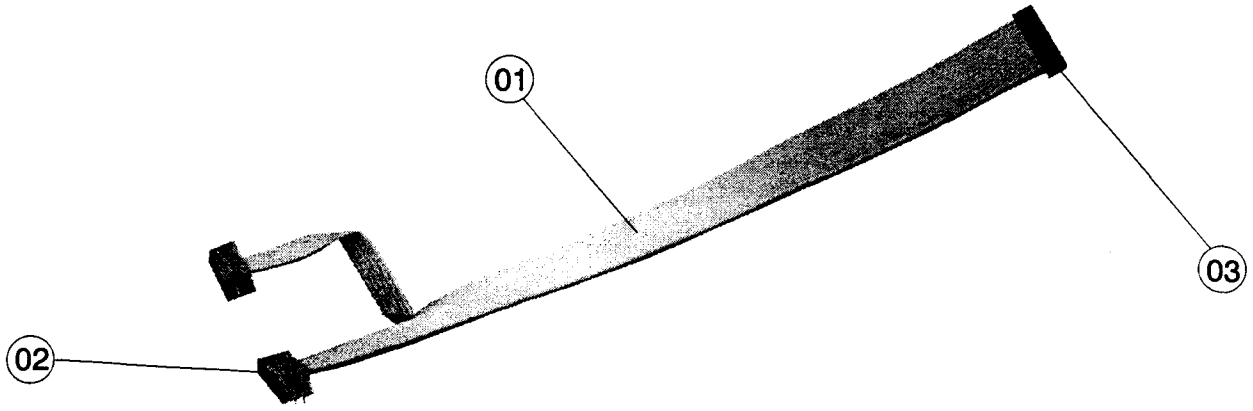


ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	041-0021-00	4	357-0632-05	7	704-0754-07
2	305-0001-00	5	370-0010-00		
3	312-0080-00	6	540-0142-00		

SEE BILL OF MATERIAL 704-0754-05 (PAGE 18 - 46) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 28, COMPRESSOR ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	041-0021-00	COMPRESSOR, DIAPHRAGM	N/A
2	1	305-0001-00	CABLE TIE, MINIATURE, 4" LG	N/A
3	1	312-0080-00	TAPE, ELECTRICAL, 3/4" W X 12" LG	N/A
4	2	357-0632-05	SCREW, PH, FLAT HD, 6-32 X 5/16	N/A
5	1	370-0010-00	SPRING, .360 OD X 3 1/2" LG	N/A
6	1	540-0142-00	HOSE, PVC, 3/8 ID X 1/2 OD X 4 1/2"	N/A
7	1	704-0754-07	ASSY, AUTOCAL VALVE	N/A

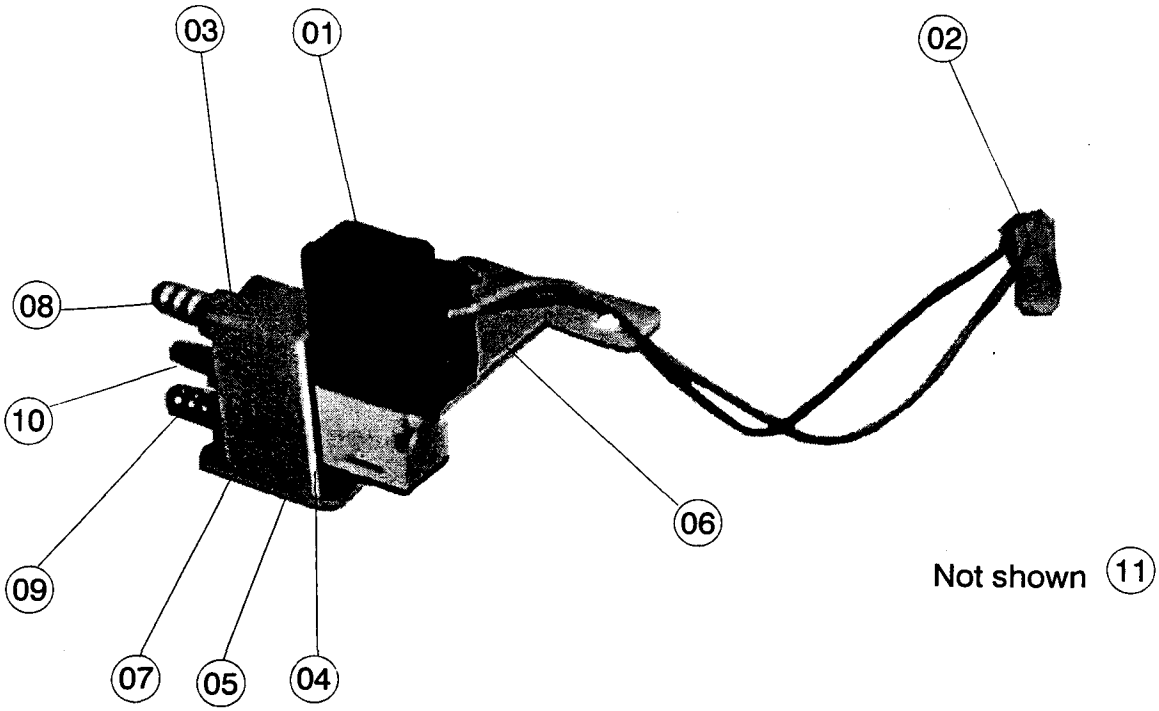


ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	010-0024-00	2	092-0010-00	3	093-0052-14

SEE BILL OF MATERIAL 704-0754-06 (PAGE 18 - 48) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 29, RIBBON CABLE ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	010-0024-00	CABLE, RIBBON, 14-COND, 10"	N/A
2	2	092-0010-00	CONNECTOR, TRANSITION HDR, 10-PIN	N/A
3	1	093-0052-14	CONNECTOR, PLUG, 14-PIN, IDC	N/A

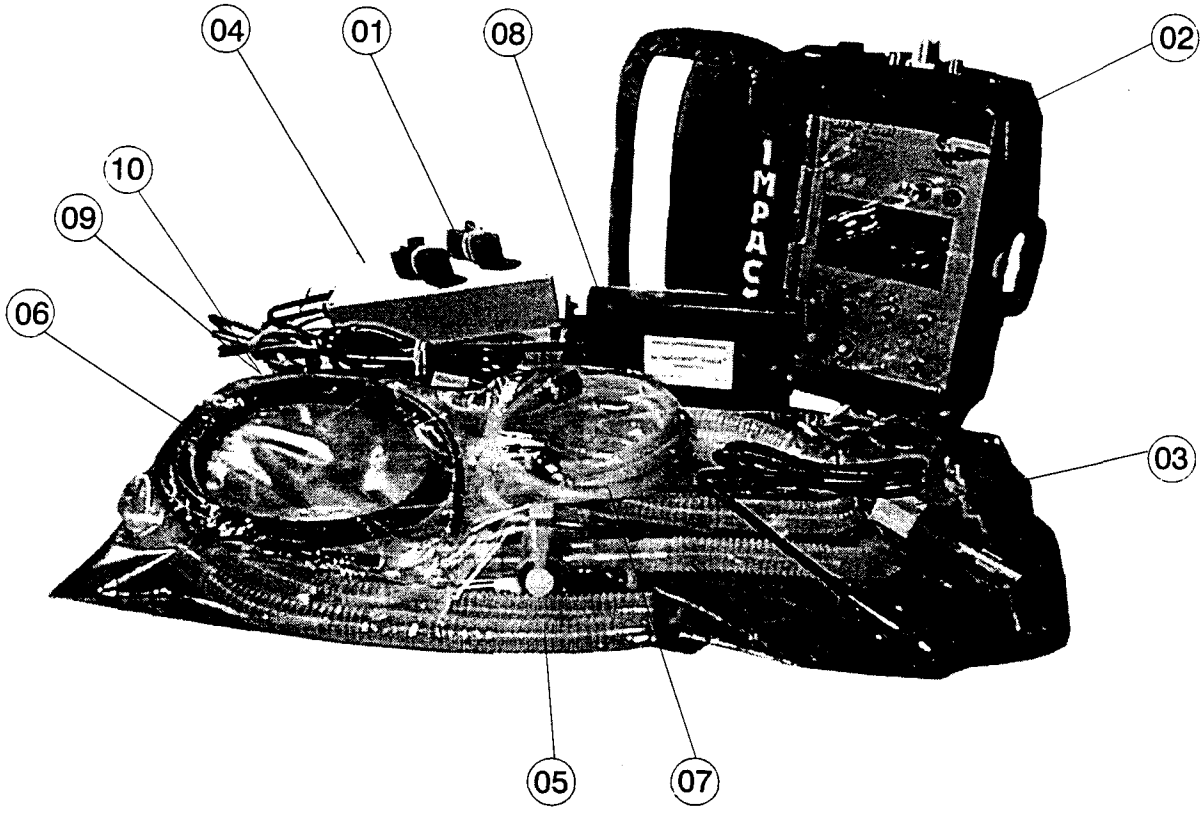


ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	033-0013-00	5	357-0440-05	9	480-0194-00
2	093-0061-02	6	404-0754-41	10	480-0227-00
3	340-0062-00	7	470-0754-61	11	602-0006-00
4	340-0077-00	8	480-0192-00		

SEE BILL OF MATERIAL 704-0754-07 (PAGE 18 -50) FOR COMPLETE PART NUMBER DESCRIPTION

FIGURE 30, AUTOCAL VALVE ASSEMBLY

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	033-0013-00	SOLENOID, 5-VDC, 3-WAY	N/A
2	1	093-0061-02	CONNECTOR, PLUG, 2-PIN, IDC	N/A
3	2	340-0062-00	GASKET, NEOPRENE, 1/4" ID X 3/8" OD	N/A
4	1	340-0077-00	GASKET, SOLENOID	N/A
5	2	357-0440-05	SCREW, PH, FLAT HD, 4-40 X 5/16	N/A
6	1	404-0754-41	BRACKET, MTG, AUTOCAL SOLENOID	N/A
7	1	470-0754-61	MANIFOLD, AUTOCAL SOLENOID	N/A
8	1	480-0192-00	HOSEBARB, 10-32 X 1/8 ID, BRASS	N/A
9	1	480-0194-00	HOSEBARB, 10-32 X 1/8 ID, NICKEL PLATE	N/A
10	1	480-0227-00	HOSEBARB, 10-32 X 1/8 TUBE, RED	N/A
11	A/R	602-0006-00	VIBRATITE	N/A



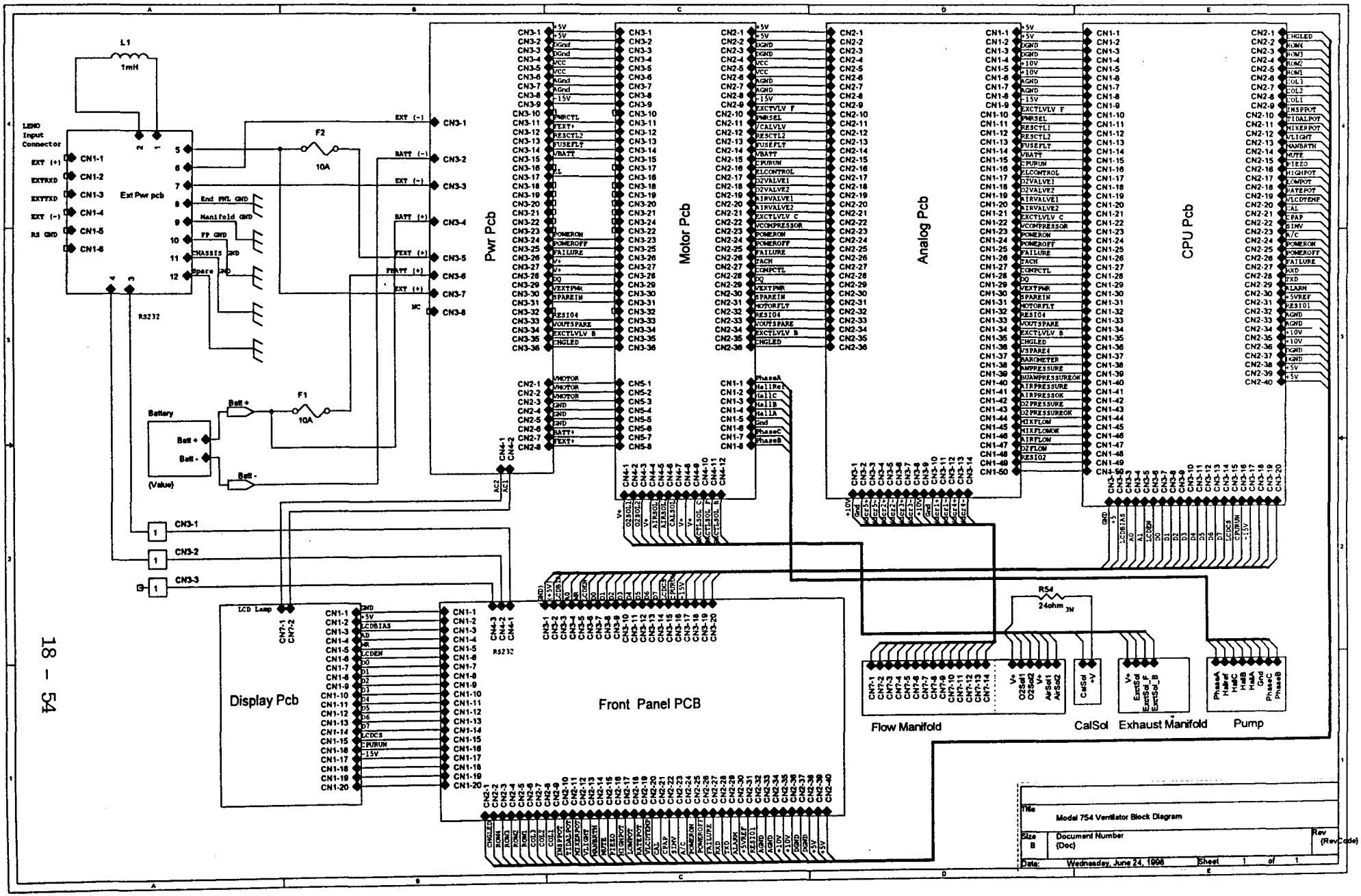
ITEM	IMPACT P/N	ITEM	IMPACT P/N	ITEM	IMPACT P/N
1	334-0020-00	5	820-0067-00	9	906-0754-02
2	402-0014-00	6	825-0002-00	10	940-0001-00
3	703-0754-03	7	825-0004-00		
4	703-0754-09	8	903-0754-02		

SEE BILL OF MATERIAL 802-0754-02 (PAGE 18 - 52) FOR COMPLETE PART NUMBER DESCRIPTION

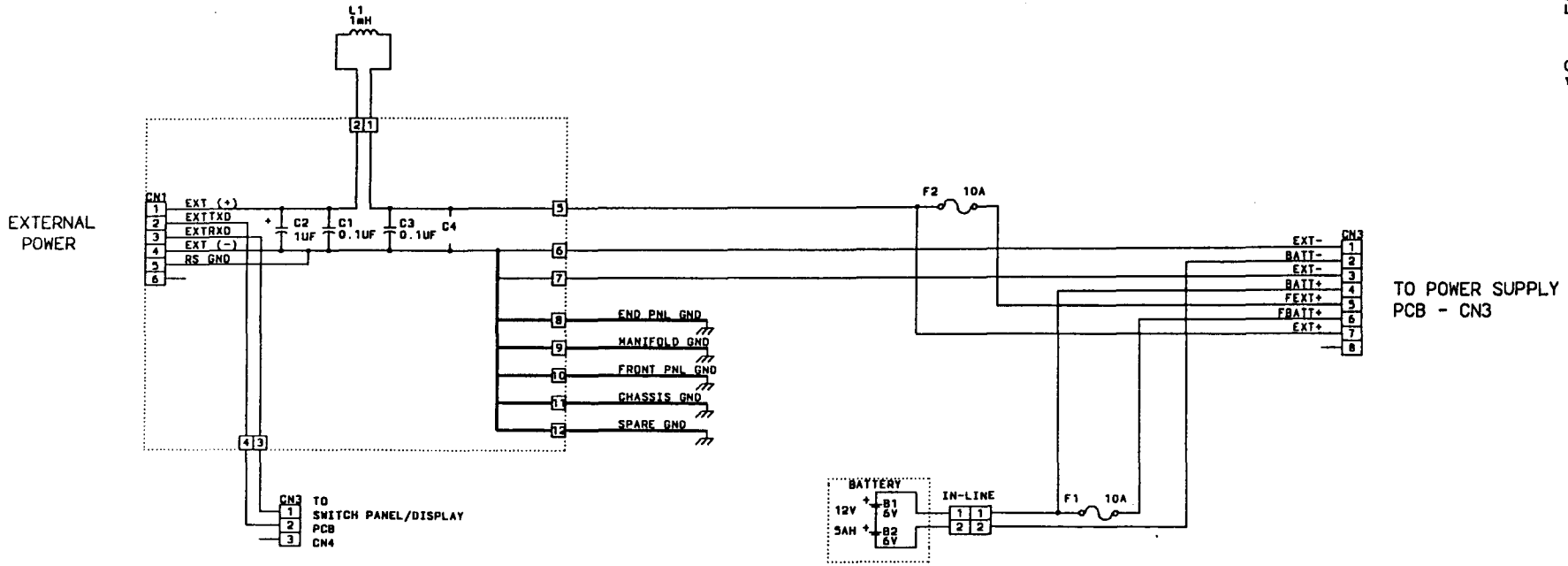
FIGURE 31, ACCESSORY KIT, MODEL 754M

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	2	334-0020-00	STRAP, VELCRO, 24" LG	N/A
2	1	402-0014-00	CASE, PADDED, VENTILATOR & ACC	N/A
3	1	703-0754-03	ASSY, DC POWER CABLE	N/A
4	1	703-0754-09	ASSY, POWER SUPPLY, OPTIONAL	N/A
5	1	820-0067-00	VENTILATOR CIRCUIT, DISPOSABLE	N/A
6	1	825-0002-00	HOSE, OXYGEN, 6' LG	N/A
7	1	825-0004-00	HOSE, AIR, 6' LG	N/A
8	1	903-0754-02	VIDEO, INSTR, MODEL 754/754M	N/A
9	2	906-0754-02	MANUAL, OPERATION & SERVICE	N/A
10	1	940-0001-00	WARRANTY CARD	N/A

ITEM NO.	QTY	IMPACT P/N	ITEM NAME/DESCRIPTION	REF DES
1	1	701-0754-01	ASSY, FINAL MECHANICAL	N/A
2	1	702-0754-01	ASSY, PCB, SWITCH PANEL	N/A
3	1	702-0754-02	ASSY, PCB, ANALOG	N/A
4	1	702-0754-03	ASSY, PCB, CPU	N/A
5	1	702-0754-04	ASSY, PCB, POWER SUPPLY	N/A
6	1	702-0754-05	ASSY, PCB, MOTOR DRIVE	N/A
7	1	703-0754-01	ASSY, FLOW MANIFOLD	N/A
8	1	703-0754-03	ASSY, DC POWER CABLE	N/A
9	1	703-0754-04	ASSY, EXHAUST MANIFOLD	N/A
10	1	703-0754-05	ASSY, LOWER CASE	N/A
11	1	703-0754-06	ASSY, UPPER CASE	N/A
12	1	703-0754-09	ASSY, POWER SUPPLY, OPTIONAL	N/A
13	1	704-0754-01	ASSY, BATTERY PACK	N/A
14	1	704-0754-03	ASSY, PCB, FILTER	N/A
15	1	704-0754-04	ASSY, COMPRESSOR AIR INLET	N/A
16	1	704-0754-05	ASSY, COMPRESSOR	N/A
17	1	704-0754-06	ASSY, RIBBON CABLE	N/A
18	1	704-0754-07	ASSY, AUTOCAL VALVE	N/A
19	1	802-0754-02	ASSY, ACCESSORY KIT, MODEL 754M	N/A


Pwr Pcb
Motor Pcb
Analog Pcb
CPU Pcb
Ext Pwr pcb
Display Pcb
Front Panel PCB
Flow Manifold
CalSol
Exhaust Manifold
Pump
Battery
LCD Lamp
Model 754 Ventilator Block Diagram
Document Number
(Doc)
Wednesday, June 24, 1998

REVISIONS			
REV NO.	CHANGE LEV	DATE	APPR.



		IMPACT INSTRUMENTATION WEST CALDWELL, NEW JERSEY	
APPROVAL	DATE	754 VENTILATOR POWER WIRING	
DRAWN CB	4/15/96		
CHECKED HK	4/15/96	SCALE NONE	C DRAWING NO. 240-0754-00-4
REV.C			SHEET 1 OF 1

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IMPACT Instrumentation, Inc.

27 Fairfield Place, West Caldwell, NJ 07006
P.O. Box 508, West Caldwell, NJ 07007-0508

Using Assembly, Kit, Oxygen Reservoir with low pressure/low flow oxygen and Uni-Vent™ MODEL 754/754M

Reorder Part Number 820-0097-15 (Case/15)

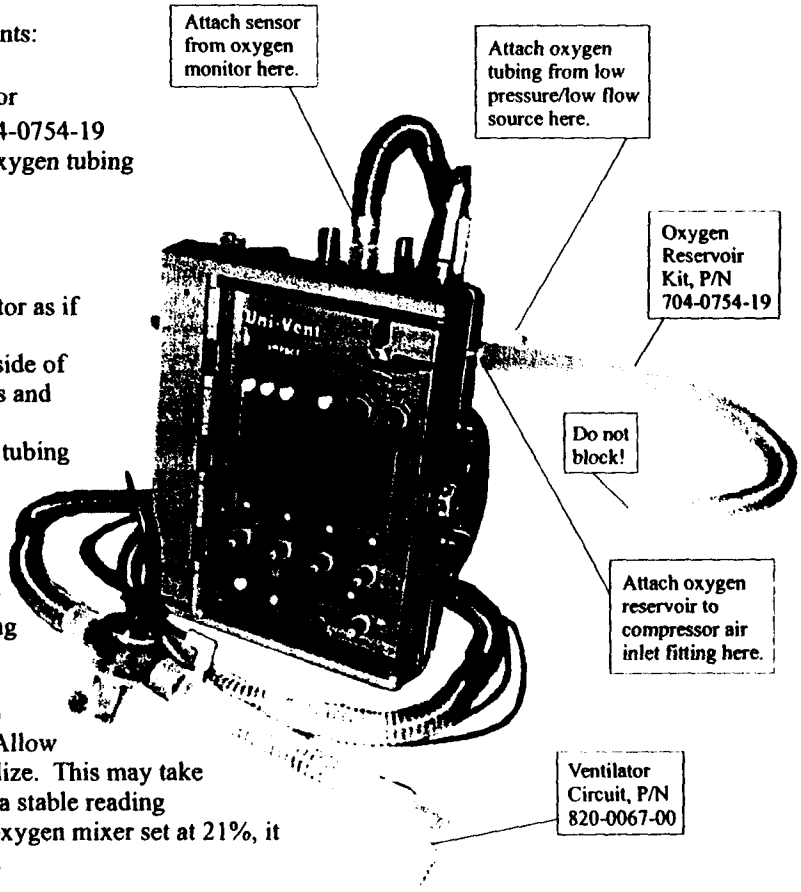
INTRODUCTION

The Uni-Vent™ Model 754/754M can be used with low pressure/low flow oxygen. Low pressure/low flow oxygen is commonly available from oxygen concentrators, oxygen cylinders with 50-PSI inhalation therapy regulators, and low pressure/low flow regulated liquid oxygen systems. Setup takes just a few seconds.

WHAT DO YOU NEED?

The complete system consists of only 4-key elements:

1. Uni-vent™ Model 754/754M Portable Ventilator
2. Oxygen Reservoir Kit, Impact Part Number 704-0754-19
3. A low pressure/low flow oxygen source with oxygen tubing
4. An oxygen monitor


Attach sensor from oxygen monitor here.
Attach oxygen tubing from low pressure/low flow source here.
Oxygen Reservoir Kit, P/N 704-0754-19
Do not block!
Attach oxygen reservoir to compressor air inlet fitting here.
Ventilator Circuit, P/N 820-0067-00
Uni-Vent

CONNECTING THE ELEMENTS

1. Except for the oxygen monitor, connect ventilator as if normal operation is intended (see figure).
2. Connect oxygen monitor sensor to inspiratory-side of ventilator circuit. This will prevent exhaled gas and moisture from effecting its readings.
3. Connect oxygen reservoir (see figure). Extend tubing to desired length to increase reservoir capacity.
4. Connect oxygen tubing from low pressure/ low flow oxygen source to oxygen nipple of reservoir (see figure).
5. Begin operation, making sure low pressure/low flow oxygen source is on (flowing) and allowing for any period of time necessary for it to begin producing oxygen.
6. Take oxygen readings and make adjustments to flow from oxygen source or to reservoir size. Allow oxygen content in the ventilator circuit to stabilize. This may take several breaths before oxygen monitor renders a stable reading
7. Avoid nuisance alarms - leave ventilator's air/oxygen mixer set at 21%, it is not used with low pressure/low flow oxygen.

HOW DOES IT WORK?

During normal operation, ambient air is drawn through the compressor's air inlet fitting and delivered to the patient each time the internal compressor cycles "on". By attaching the Oxygen Reservoir Kit, you can oxygen-enrich the gas that's delivered to your patient. During "off" cycles, oxygen is allowed to flow into the reservoir. Any excess oxygen volume vents outside the reservoir. During "on" cycles, oxygen is drawn from the reservoir into the compressor and delivered to the patient. Using the reservoir permits delivery of higher oxygen concentrations without having 50-psi oxygen available.

P/N 906-0754-11 Rev. 0 (02/01)

Tel: 973.882.1212 Fax: 973.882.4
Web Site & E-Mail: http://www.impactinstrumentation.